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CONTENTS

/9987

CHINESE 7760 CAD/CAMM SOFTWARE SYSTEM INTRODUCED

Beijing GUOJI HANGKONG [INTERNATIONAL AVIATION] in Chinese No 4, Apr 87
pp 2-4, 58

[Article by Zhao Xuexun [6392 1331 6064]]

[Excerpt] The 7760 CAD/CAMM system is a computer-aided aircraft design, manufacturing and management system developed by the Ministry of Aviation Industry. It was initially developed in the early 1980's in Xi'an for the purpose of aircraft development. After several years of continuing improvement and tests of the various subsystems, the entire system was certified and accepted in October 1986 by an organization of the Ministry of Aviation Industry (see issue No 1, 1987 of GUOJI HANGKONG).

This system is managed at three different levels: system, branch system, and subsystem. The branch system is the specialized unit of the system, and the subsystem is the technical unit. The technical modules are classified according to the individual specializations, and they are integrated according to the vertical relationships of the individual programs in the design process. The entire system consists of 11 branch systems and 40 subsystems; it contains approximately 45,000 lines of source code.

Special Features of the System

The exploitation environment of the 7760 CAD/CAMM system was gradually evolved during the development process. The basic exploitation and operation environment is a SIEMENS 7760-7536 computer local network which consists of a character terminal, a plotter, and a graphic work station. The corresponding software includes a business-oriented general data base management system UDS, and a computer-aided design interactive system CADIS-2D. The hardware configuration is a "direct connection model" in which a large-scale computer is used as the central processing unit and many directly-connected terminals are used as work stations.

This system uses a two-stage information management system where data and files are stored together. The subsystems are independent from one another; their internal information is managed by files. The data base serves as the nucleus

of the system, where the various subsystems are integrated to form a unified interface; it is used to store and transmit the information shared by the entire system.

1. Integrated System

The nucleus of the system is the data base, where various subsystems used for aircraft design, numerical control programming, and production planning and management are integrated.

2. Evolutionary System

The 7760 CAD/CAMM was developed using structural design methods and modularized program structures. A subsystem with a rather complete specialized function is chosen as the basic unit for system integration; each subsystem is composed of functionally independent modules.

3. Interactive Graphic System

On the basis of the CADIS-2D system, a large number of special functions have been added and a Chinese-character system was developed to establish the interactive graphic system CADISC. The batch processing modules all have plotting capabilities.

4. Design for Specialized Users

The 7760 CAD/CAMM is a multi-specialization system; its design is not only user-oriented but also provides various specialized features. In addition to batch processing, it also has an interactive mode of operation where various command languages and "menus" are provided to facilitate man-machine communication. Also, a variety of utility programs have been developed to aid user operation.

5. Transferrable System

In order to facilitate conversion between computer systems, software transferrability is a major consideration in the system design. All specialized application programs are coded in FORTRAN-IV language; the data base system is coded in the nested host language COBOL; the executive and control programs are coded in PASCAL language. Also, complete documentation exists for all the subsystems.

System Capabilities

The operational modules provided in the 7760 CAD/CAMM system generally cover the main lines of the aircraft design process; they are also connected to the numerical control programming function and the production planning and management function in aircraft manufacturing. Supported by the data base, the user can activate the executive control operating system to establish a unified

and coordinated information flow in the computer, and to achieve automated transfer of data, drawings, process information and documents in design, manufacturing and management (see diagram below).

Computer-Aided Design (CAD) Capability

1. Parameter Selection--the "Space Boundary Method" System

The basic parameters of an aircraft not only affect its tactical and technical performance, but also determine the initial design of its key components. The 7760 CAD/CAMM system recommends a unique engineering optimization method for overall parameter selection--the space boundary method. It uses two of the basic design parameters as the optimization parameters and the major tactical/technical indices as constraint conditions. It can show on the graphic display unit the optimum parameter combination, the magnitude of the optimum objective function which satisfies all the tactical/technical requirements, and the parameter combination in the neighborhood of the optimum objective function. In addition, it can also provide initial verification of the tactical/technical requirements.

2. Overall Aircraft Design

Overall Topological Design System. Pre-stored in the 7760 CAD/CAMM data base are standard drawings and data for a number of prototype aircraft, standard aircraft components, and key equipment. Based on the tactical/technical requirements, the user can use the interactive mode to design the fuselage layout, and determine the approximate shape of the fuselage using information in the data base. Then he can select a basic wing configuration based on flight performance requirements, and design the stabilizers, complete the overall layout and prepare a three-dimensional draft drawing based on maintenance, c.g. control, and flight quality requirements.

Automated Optimum Design System for Selecting Overall Aircraft Parameters. Once the basic configuration of the aircraft is determined, one can use the automated optimum design subsystem to search for the optimum parameters which satisfy the tactical/technical requirements. The various optimization subsystems in 7760 CAD/CAMM provide a wide selection of optimization modules and special processing modules. For a given engine selection, one can perform parameter optimization and analysis for the overall design of various aircraft such fighters, fighter-bombers and civilian airplanes under the constraint of meeting tactical/technical requirements. By alternately using this system and the system for overall topological design, one can arrive at the final aircraft layout and prepare a three-dimensional drawing from which the control parameters of the aircraft profile can be determined.

Three Dimensional Display of Overall Aircraft Configuration--the CADISC System. By using the control parameters of the aircraft profile, this system can construct three-dimensional line structures of the aircraft model on the graphic display unit to allow the designer to examine the overall topology of the aircraft (see front cover).

System for Calculating Aircraft Performance. It can calculate 24 key performance indices of the aircraft such as speed, cruising range, take-off and landing characteristics, and lateral mobility. In determining the fuel requirement based on specified flight cross sections, calculations can be carried out from sea level to 20 km at 1-km intervals. In addition to calculating point-wise performance, one can also obtain the flight envelope by calculating the flight cross-sectional characteristics.

3. Design of Aircraft Profile

The geometric profile of the aircraft is determined primarily by aerodynamic considerations and the interior layout; it also serves as a basis for carrying out further structural and interior designs. Therefore, the geometric information is useful in the entire design process.

System for Designing Wing Configuration. It is a simple and practical interactive system for wing design; it can perform such functions as constructing a wing profile based on pressure distribution, modifying known profiles, combining camber and thickness; it can also perform overall geometric and aerodynamic analyses of the wing design.

System for Designing Geometric Profile. Its main function is to use the profile control parameters and apply rigorous mathematical techniques to define the three-dimensional geometric shape of the aircraft and its components in order to provide a common mathematical model for various specialized applications. It is used primarily to construct wind tunnel models, to analyze the available space in fuel tanks and interiors, to calculate the aerodynamic distribution, and to provide the profiles for structural design. To accommodate practical engineering needs, this system contains various forms of the definitions of curves and surfaces which can be converted from one to the other.

4. Analysis of Aerodynamics Characteristics

Engineering Estimation System for Longitudinal Aerodynamic Characteristics. By using the method of engineering estimation, this system can calculate the longitudinal aerodynamic characteristics of aircraft with conventional, variable-sweep, and supercritical wing configurations under subsonic, transonic and supersonic conditions. It can either be used to inspect the profile design of the aircraft and its components from a "global" point of view or be included in the optimization system by linking it with other subsystems.

Numerical Analysis System for Analyzing Aerodynamic Characteristics. An important measure of the "microscopic" configuration of an aircraft is obtained by calculating the pressure distribution over the aircraft and its components. This system is established on the basis of linearized inviscid flow; it can perform systematic analyses and calculations of the aerodynamic characteristics of different airfoil configurations, fuselages, wings, integrated bodies, or even the entire aircraft with simple appendages. It provides reference information for profile design and estimates preliminary aerodynamic loads for prototype structural design.

5. Structural Design

Structural Design System. Through system commands, the designer can carry a dialogue with the system, and perform structural design dynamically. He can carry out geometric adjustment and design of body shapes, and construct structural graphics on the screen; he can also perform engineering analysis, add dimensions, titles and labels to produce a complete structural drawing. In addition, one can set up a finite-element model of the structure, and carry out structural optimization design; by linking it to other branch systems, one can also carry out finite-element analysis of the design.

Optimization Design System With Multiple Wing Surface Constraints (YIDOYU-1). This is an automated design system which performs optimization for a given set of constraints and objective function; it is primarily used for wing surface structures. For a given structural topology and given material which satisfy multiple constraint conditions, it can select the element cross-sectional parameters and weights so that the structural weight is minimized. It can also perform multi-facet structural analysis, full-stress analysis, as well as optimized design using the method of mathematical programming.

6. Structural Analysis

The HAJIF-I Model. The aeronautical structural analysis system I (HAJIF-I) is primarily used to investigate linear distortion and to perform stress analysis of various thin-wall structures, trusses and frames under external load. The largest problem that can be handled by this system consists of 99 substructures, and each constrained node has 3000 degrees of freedom. The system provides a user-oriented special language; it can carry out either 15 fixed analysis flow charts or a set of flow charts specified by the user.

The HAJIF-II Model. It is primarily used for the dynamic analysis of aeronautical structures such as calculating the inherent dynamic characteristics of the structure and the flutter and gust responses of the aircraft with active control system. Through a global command the user can perform dynamic analysis either by activating 31 fixed flow instructions or by combining 21 hybrid flow instructions.

The HAJIF-III Model. This system is primarily used to solve nonlinear structural problems which include static-linear thermal stress analysis, plasto-elastic stress analysis, torsion analysis, large displacement or large deformation analysis, and combined large deformation plasto-elastic stress analysis.

7. Construction of Modal Lines

By using the geometric profile design and structural design segments of the system, one can directly obtain the theoretical modal lines and structural modal lines. For existing drawings, one can plot the theoretical modal lines and structural modal lines on a plotter using the CADISC system.

Computer-Aided Manufacturing (CAM) Capability

As a result of the extensive use of integrated structures on modern aircraft, the amount of machine-processing is increasing rapidly. Therefore, one of the main functions of the 7760 CAD/CAMM system is programming the graphic device. The CAM segment of the system can show a picture of the design on the graphic device, and use a cursor to indicate the element to be machine-processed. A sequence of commands can be programmed to show the trace of the cutter, and create a file of cutter positions. After examination of the file, a paper tape created to be used on a lathe for machining the actual part. The CAM segment is equipped with numerical control programming systems with two-dimensional, two-and half dimensional, three-dimensional and five-dimensional coordinates. It can perform numerical control programming and create the processing paper tapes for two-dimensional planar parts, planar parts with grooves and transition lines, wall board type parts and frame parts with variable inclinations.

Computer-Aided Production Planning and Management (CAPM)

In the area of aided management, the 7760 CAD/CAMM system has established an integrated production planning and management information system centered around a production planning and management data base. It is used to store information on product structures, standard parts, raw materials, finished products, machine tools, man-hour specifications, and parts inventory; it can also generate production plans for work shops based on drawings, inventory conditions and factory production tasks.

Application Results

All the subsystems and the entire 7760 CAD/CAMM system have been certified and accepted for operational use one-by-one based on specific results of applications; some have become important tools for model development. For example, the HAJIF system used for aeronautical structural analysis is a complete and comprehensive structural analysis package that exists in China today. It has been used for the design of China's fighter aircraft, bombers, target planes, helicopters, seaplanes and cargo planes with very good results. By establishing geometric relations between the overall aircraft parameters and the model point arrays in its geometric design system, the traditional method of constructing mathematical models from theoretical drawings has been replaced. During the design process, the designer can construct the profiles of different parts of the aircraft, produce the necessary drawings, and plot the theoretical modal lines based on a small number of parameters. Preliminary results of engine design show that the design efficiency can be increased by a factor of 3. The interactive design segment of the system contains the shapes of a large number of standard parts, and is equipped with various global commands for constructing design drawings; it also has engineering analysis capability, which can be used in conjunction with the construction of design

drawings. In the prototype design of typical parts of an aircraft, this system can improve the design efficiency by a factor of 5 to 6 compared to traditional methods. The subsystems used for numerical control programming of the graphic devices play an important role in model production. Users of the system are generally impressed by its ease of operation and flexibility, accurate diagnosis and easy modification. Compared to other numerical control software, the design cycle can be reduced by at least a factor of 3, and the design efficiency can be increased by a factor of 5-6. In particular, when it is used in conjunction with other subsystems, the number of iterations can be greatly reduced. Favorable results have also been reported since the production planning and management information system was put into service. For example, originally it took 2-3 days to compile a monthly plan for a shop, now it only takes several minutes.

3012/8309
CSO: 4008/45

CERAMIC SUPERCONDUCTORS MOVE TOWARD COMMERCIALIZATION

Beijing RENMIN RIBAO OVERSEAS EDITION in Chinese 2 May 87 p 1

[Excerpt] Following major breakthroughs in superconductor research by the Institute of Physics of the Chinese Academy of Sciences (CAS), the Shanghai Silicate Institute has recently developed a superconductor 100 mm in diameter, the largest to date in China. With this development, China's ceramic superconductors have taken a major step toward the commercialization stage.

The superconductor was developed in less than one month using an yttrium-barium-copper oxide system. Tests have shown that the initial transition temperature is greater than 100 K, the zero resistance temperature is 95 K, and the transition width of some samples is less than 1 K. The initial transition temperature of each test sample ranged from 97 K to 102 K, and the zero resistance temperature ranged from 94 K to 97 K, demonstrating good stability and repeatability.

In order to produce better superconductors and to ascertain the superconducting mechanism, the researchers used high-resolution electron microscopy, micro-diffraction, EDS energy spectrum analysis, and polycrystalline x-ray diffraction, etc., to study the structure of the superconductor.

/8309
CSO: 4008/69

SUPERCONDUCTOR DEVELOPMENTS UPDATED

Barium-Yttrium-Copper Oxide Superconductor

Beijing GUANGMING RIBAO in Chinese 6 May 87 p 1

[Excerpt] A research team composed of members of the Department of Chemistry, Department of Electronics, and the Department of Physics at Nankai University has recently achieved gratifying results in superconductor research. The results, which have been confirmed by the Institute of Physics of the Chinese Academy of Sciences, show that the barium-yttrium-copper oxide superconductor's initial transition temperature is above 118 K, the median transition temperature is 93 K, and the zero resistance temperature is 91.6 K. The superconductor is formed using a double sintering process under oxygenated conditions. Repeat tests confirm that the superconductor's performance is stable, with the Meissner effect observable in liquid nitrogen. Nankai University is presently studying the structure and mechanism of the superconductor.

CAS Develops Superconducting Thin Film

Beijing RENMIN RIBAO OVERSEAS EDITION in Chinese 21 May 87 p 4

[Excerpt] A research team at the Institute of Physics in the Chinese Academy of Sciences led by Zheng Jiaqi has developed a superconducting thin film with a zero resistance temperature of 77 K. A similar achievement regarding a superconducting film in the liquid nitrogen range has already been reported by a U.S. firm. The barium-yttrium-copper oxide superconducting film in question has a surface area of 3 x 10 mm^2, and is one micron thick. After high-temperature heat processing, a sample evinced metallic characteristics. Its initial transition temperature is 96 K, the median transition temperature is 87 K, and the transition width is 7-9 K. In addition, it has diamagnetic characteristics. The superconducting thin film was reportedly produced using vacuum evaporation technology. It is formed when, under high vacuum conditions, the barium-yttrium-copper oxide material is continuously bombarded with an electron beam from an electron gun, causing it to heat and fuse and generating steam molecules so that a thin film is continuously deposited on a special substrate surface. Repeated tests have confirmed that the characteristics of this thin film are stable.

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IMPROVED BACKFIRE ANTENNA USING CIRCULAR DIPOLE

Beijing DIANZI KEXUE XUEKAN [JOURNAL OF ELECTRONICS] in Chinese Vol 9, No 1, Jan 87 pp 82-84

[Article by Song Ximing [1345 6932 2494], Li Ruihua [2621 3843 5478], Zhang Yufeng [1728 3768 1496], and Rao Boliang [7434 0130 5328] of the Huanghe Machine-Building Factory: "A Small Horizontal Size Backfire Antenna Using Circular Dipole"; manuscript submitted on 28 August 1985, revision received on 20 July 1986]

[Text] Abstract: A backfire antenna using a circular dipole of very small lateral dimension (approximately equal to 0.5 λ) is described in this paper. Its structure and experimental results are introduced. The experimental results show that the antenna has improved electrical performance.

1. Introduction

As we know that when the arm length of a linear dipole antenna $L > 0.7\ \lambda$, its maximum radiation direction is no longer perpendicular to the axis of the dipole ($\theta = 90°$). Furthermore, its gain does not rise as rapidly as the dipole length continues to increase. This is because although the main lobe narrows with increasing dipole length yet the number of lobes also increases. The basic reason for more lobes is because there is a reversed phase current at the dipole. Therefore, the useful length of the linear dipole is limited within the range $L \leq 0.5\ \lambda$.

In recent years curved dipoles were investigated internationally [1-3]. The physical essence of a curved dipole is to alter the dipole arm from a straight line to a curve. It uses the time delay caused by the path difference to compensate the phase difference of the current in order to maintain the maximum radiation in the $\theta = 90°$ direction on the equatorial plane and to improve the gain by lowering the voltage level of secondary lobes.

To date, with either a Gaussian curve or loop dipole, the gain can be significantly improved. However, the lateral dimension of this type of dipole is noticeably increased (curve length is 1.5 λ), resulting in a cumbersome structure. This is a disadvantage of the conventional curve dipole antenna.

In order to overcome this shortcoming, we are developing a circular dipole which is used as the feed of a backfire antenna. The lateral dimension of this dipole is only about 0.25 λ (the actual length of the curve is approximately 0.5 λ). The diameter of the primary reflector of the backfire antenna is only about 0.5 λ. The longitudinal size is around 1 λ. This backfire antenna still has good radiation characteristics.

2. Basic Concept

As we know, there is a specific requirement for the diameter of the main reflector of a backfire antenna [4,5]. For instance, the diameter of the main reflector of a short backfire antenna should be approximately 2 λ. It should be about 4-6 λ for a long backfire antenna. The purpose of enlarging the main reflector is to block most of the energy along the axial direction of the antenna and to make it travel in the opposite direction. Usually, the cross-section of the "channel" gets larger as the phase velocity increases, i.e., it increases as the structure length gets longer. Therefore, when the antenna length is increased, the diameter of the reflector must also be increased correspondingly.

In order to reduce the diameter of the main reflector, it is necessary to decrease the cross-section of the "channel." The way to do it is to use a curved dipole.

The principle of a circular dipole backfire antenna is shown in Figure 1. The curve length of the circular dipole is approximately 0.5 λ. The transverse physical dimension is about 0.25 λ. Because the length of the circular dipole is around 0.5 λ, there is no reverse phase current on the dipole. However, there is a path difference due to the curvature of the dipole. This path difference is compensated by an adjustment cup and adjustment disk to retain its good radiation characteristics. The diameter of the main reflector is approximately 0.5 λ. The height of the ring is around 0.25 λ. The total length of the antenna is approximately 1.25 λ.

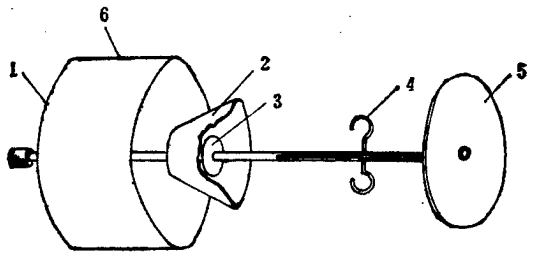

Figure 1. Schematic Diagram of a Backfire Antenna Using Circular Dipole

1. 0.5 λ diameter main reflector
2. Adjustment cup
3. Adjustment disk
4. Circular dipole
5. Pre-reflector
6. Ring

3. Experimental Results

Experiments were done on the antenna designed on the f = 700MHz band to obtain the directive pattern, gain and voltage standing wave ratio.

(1) Directive Pattern

Figure 2 shows the experimental directive pattern at the central frequency. The width of the half power point is about 50° in the H plane and 42° in the E plane.

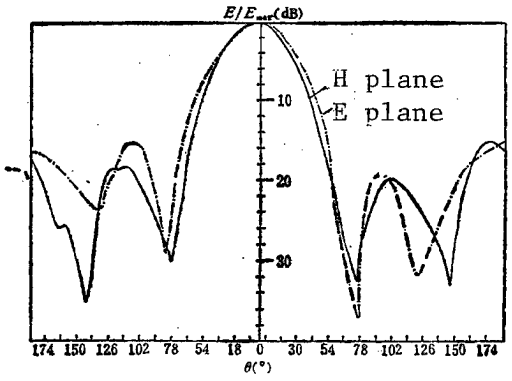

Figure 2. Experimental Directive Pattern at Center Frequency

(2) Gain

The gain is measured by comparison. The standard antenna is a multiple unit directive antenna with a gain at 10.5 dB. The measured gain is about 12 dB. Figure 3 shows the variation of the measured gain with frequency within a certain band width.

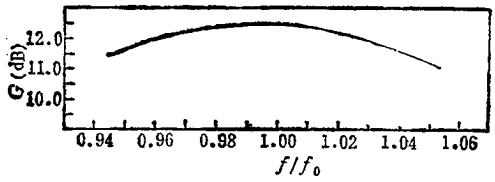

Figure 3. Variation of Gain With Frequency

(3) Voltage Standing Wave Ratio

Figure 4 shows the measured voltage standing wave ratio as a function of frequency. A good impedance match can be obtained by the careful design of an impedance converter.

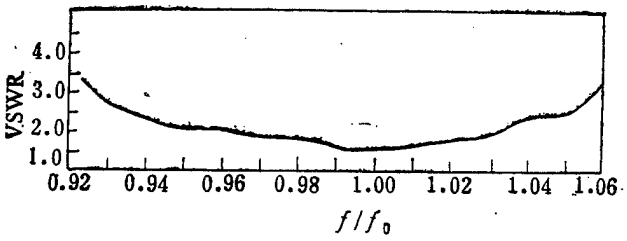

Figure 4. Variation of Voltage Standing Wave Ratio With Frequency

4. Conclusions

The experimental study on a backfire antenna using a circular dipole showed that, as compared to a short linear backfire antenna, its gain (15.2 dB) decreased by approximately 3 dB and its longitudinal dimension increased by about 0.5 λ. However, its lateral dimension is only approximately one-fourth that of a short backfire antenna. Based on this information, let us roughly estimate for a short linear backfire antenna. When the lateral dimension is decreased to one-fourth the original size, the area of the main reflector is reduced to one-sixteenth the original size. The gain should be decreased by approximately 12 dB. The increase in longitudinal length by one-fold increases the gain by about 3 dB. Thus, the total gain is approximately 6 dB. The gain of the antenna tested in this work is about 12 dB. Therefore, it is more efficient. This is not achievable by a $\lambda/4$ length linear dipole backfire antenna.

The key to the success of this antenna is the optimization of the design of the circular dipole antenna and the adjustment cup.

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12553/6091
CSO: 4008/1045

OPERATION OF ELECTRON-BEAM CONTROLLED CO_2 LASER AT 6 ATMOSPHERES

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 7, No 2, Feb 87 pp 120-125

[Article by Guo Wuming [6753 3670 7686], Yang Hongyao [2799 1347 5069], Wang Jianwei [3769 1696 4885], Xu Yizhuang [1776 0076 8369], and Wu Nianle [0702 1819 2867] of Qinghua University, Department of Modern Applied Physics; paper received 9 Apr 86; first paragraph is source-supplied abstract]

[Text] Abstract: This paper reports on the properties of a CO_2 laser controlled by an electron beam and operating under a pressure of 6 atmospheres. The discharge characteristics and tunability of the laser are studied.

I. Introduction

High pressure continuous tunable (9 μm-11 μm) lasers are extremely useful sorts of lasers. Since they possess larger pulse energies they are an important light source for research on laser chemistry and nonlinear optics.

Several people have already studied electron beam controlled CO_2 lasers operating under high pressure [1-7]. Commonly these studies have been carried out at 10 atmospheres or more. Under these conditions, the lasers can be tuned continuously. Alimpiev et al. [8] have pointed out that at 6 atmospheres (CO_2:N_2 = 1:1), the relationship between wavelength and grating angle is linear, that is the frequency drag effect does not appear. The total smooth tunable zone which they obtained reached 86 cm^{-1}. The present authors have designed and installed an electron controlled CO_2 laser which can operate under high pressure and have carried out research on its properties.

This paper emphasizes study of the frequency tuning features of a laser operating at 6 atmospheres, specially selecting the gas components to be

$$CO_2:N_2:He = 1:2:3$$

Stressing study of 10 P branch frequency tuning we measured the relationship between output energy and wavelength under fixed discharge conditions. By varying the electron gun voltage and primary discharge voltage we found its optimal operating conditions and non-arcing conditions.

II. Structure of the Laser

The laser was mainly composed of an electron gun chamber, V, and a gas discharge chamber, L, as shown in Figure 1. The electron gun chamber, V, was made of a stainless steel tube with both ends connected to the vacuum system. The vacuum could reach 4 x 10^{-6} Torr and the electron gun, H, was constructed using a strip of tantalum (or a strip of knife blade steel) which emits electrons under a high vacuum. The gas discharge chamber, L, used thick organic glass which can withstand 10 atmospheres. Between L and V for separation we used a 25 μm thick titanium film or a 100 μm thick Dacron film, ab. These films can withstand high pressure differences as well as ensure the passage of higher intensity electron beams. The anode, A, in the gas discharge chamber was made of aluminum and was 98 cm long and 3 cm wide while the cathode, C, was made of a molybdenum grid. The separation between the anode and cathode could be varied. The maximum separation was 3 cm so the discharge volume was 0.88 lit. In the actual experiments the separation was 2.2 cm and the discharge volume was 0.65 lit.

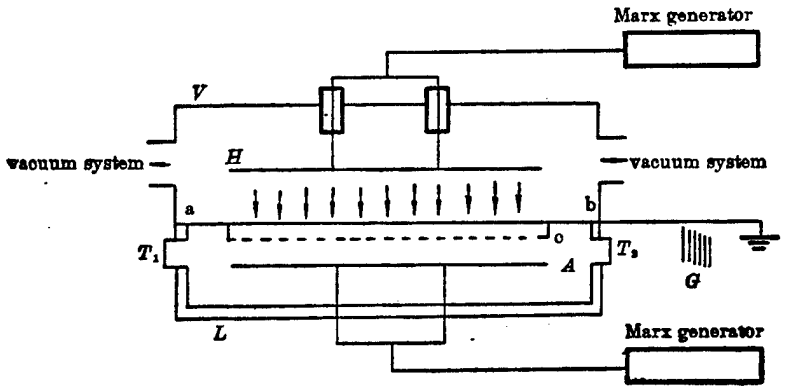


Figure 1. Schematic Diagram of the CO_2 Laser

The laser cavity used in this paper was a combination cavity composed of selenide zinc (or Ge) plane crystals T_1 and T_2 as well as the grating G. G was a 120 1/mm blazed grating. Through rotation of the grating we changed the wavelength of the laser. T_1 was the output lens. When the laser energy was larger it was appropriate to use a Ge plate for the output lens but Ge plates damage more easily and are not convenient for long operation. For conditions where the output did not exceed 3 J, we employed selenide zinc as the output lens since it could operate for long intervals and this was beneficial to the study of the tuning properties of the laser.

Because the gain is larger under 6 atmospheres, when T_1 and T_2 are strictly parallel, the parallel plane cavity which they form is sufficient to give 10P(14) oscillations. Actually, we observed dual wavelength oscillation. One was 10P(14) and the other wavelength varied with the rotation of the grating. When our purpose is to study the variation of the laser wavelength and energy with grating rotation, we desire to suppress this down to the oscillation of the laser chamber formed by T_1 and T_2. For this reason we

intentionally minutely detuned T_2. This way we got a single wavelength laser and the pulse energy also had a rather large increase. Especially when using a Ge plate output lens, the output energy can reach 15J. (The authors once used a Brewster window of KCl in place of T_2 but because of the pulse energy increase, the KCl crystal was severely damaged.)

The grating was motor driven, its speed controlled by a seconds clock to make the grating rotation angle be 0.0033°/sec within the 10P spectral zone. This is equivalent to a wavelength variation of $\Delta\lambda$ = 0.00074 μm.

The voltage source for the electron gun was a three stage Marx generator. The capacitance of each stage was 12 μF and the maximum voltage was 90 kV. The maximum voltage of the three stages in series was 270 kV. The primary voltage source was a two stage Marx generator. The capacitance of each stage was 1.1 μF and the maximum voltage was 60 kV so for the two stages in series, the maximum voltage was 120 kV. The trigger intervals of the two sources could be adjusted but in practice we adopted simultaneous trigger intervals.

III. Discharge Properties

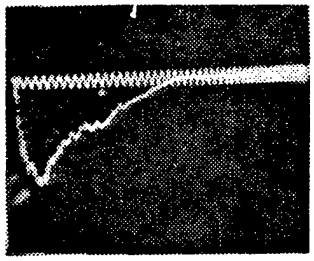
Since the laser pulse width is determined by the discharge properties, in order to get a narrower pulse, we paid attention to reducing the return circuit inductance as much as possible in the circuit design and installation so as to obtain a shorter pulse and steeper leading edge. For this paper, by the standard method [10] we used an OK19M2 high voltage oscilloscope, photon drag probe, and Tektronix 466 memory oscilloscope to carry out measurements on the discharge properties of the laser. The measured results are as shown in Figure 2.

From Figure 2(a)-(d), we can see that the voltage and current wave heads are all relatively short. It is just this part that determines the laser pulse width. From Figure 2(e) we see that the laser pulse width is about 60 ns which is rather narrow.

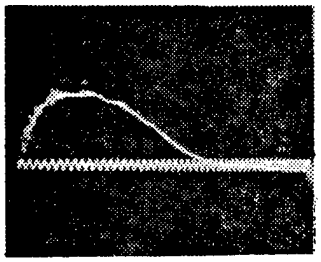
We also measured the delay between the electron gun voltage and primary discharge voltage. We discovered that, even though the triggering was simultaneous, the electron gun voltage generally led by about 1 μs.

Measurements of the electron beam current revealed that the thickness of the titanium film had a rather large influence on the size of the electron beam which was transmitted. When the electron gun voltage was 240 kV, a 50 μm thick titanium film only transmitted around one-fifth of the electron beam current. When the electron gun voltage was lowered to 200 kV, a 25 μm thick titanium film transmitted four-fifths of the electron beam current.

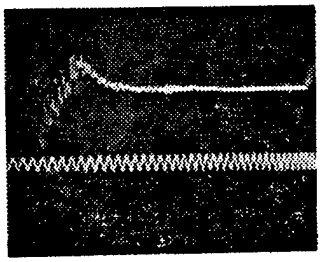
In the process of laser discharge, the occurrence of electrical arcs are disadvantageous. They can influence the laser output energy to the degree that the laser does not oscillate. The authors believe that there are two reasons for arc production: 1) The primary discharge voltage is too high and has reached the breakdown voltage; and 2) the electron beam energy is too low making the gas ions insufficiently plentiful. Consequently, this



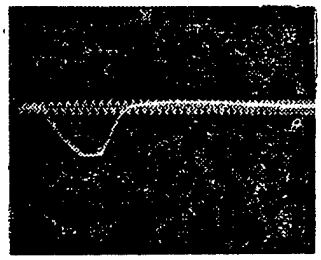
(a) Electron gun voltage
Time scale 12.9 MHz
Pulse head 0.23 μs
Pulse width 0.5 μs
Peak voltage 204.3 kV



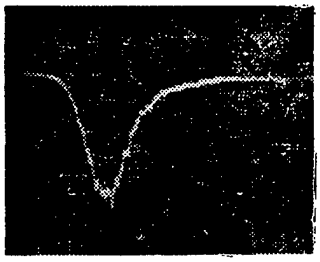
(b) Electron gun current
Time scale 12.9 MHz
Pulse head 0.35 μs
Pulse width 1.36 μs
Peak current 5.9 kA



(c) Main discharge voltage
Time scale 12.9 MHz
Pulse head 0.3 μs
Peak voltage 71 kV
Tail voltage 49 kV



(d) Main discharge current
Time scale 12.9 MHz
Pulse head 0.4 μs
Pulse width 0.54 μs
Peak current 7.5 kA



(e) Laser pulse shape
20 ns/div.
Pulse width 60 ns

Figure 2

experiment requires the primary discharge voltage to have an upper limit and the electron gun voltage to have a lower limit. When attention is paid to these two factors, non-arcing discharge is obtained. Experiments revealed that when the titanium film was 25 μm thick, the electron gun voltage should not fall below 230 kV and the primary discharge voltage should not exceed 52 kV. This is equivalent to a field strength to gas pressure ratio (E/p) = 3.9 kV/cm·atm. These conditions are the optimum values pointed out by Daugherty [11].

IV. Determination of Laser Wavelength

The authors believe that the best way to study the laser's output is to measure the laser wavelength and energy after rotating the grating through a micro-angle. On the one hand, this determines the relationship between wavelength and grating angle while on the other hand, it determines the variation of energy with wavelength. Therefore, the experiment adopted the apparatus shown in Figure 3. The laser emissions on the KCl beam splitter divided into two beams. One beam (a large part of the energy) was introduced into a spectrometer, the thermally sensitive material used to record the spectrum could only record an image for higher laser energies, and the other beam (a small part of the energy) was led into an energy meter. (The energy meter was a LPE-1A model high sensitivity energy meter of the Chinese Academy of Sciences, Physics Research Institute.) From determination of the ratio of the beam splitter's branch beams we could calculate the total emitted laser energy from the energy meter reading.

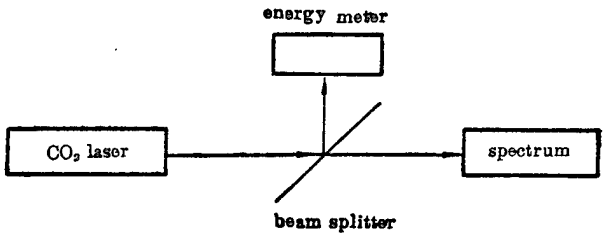


Figure 3. Arrangement for the Measurement of Laser Wavelength and Energy

The spectrometer was our home brew 2 m spectrometer. It made the laser directly illuminate a 110 1/mm blazed grating. The diffracted light through a KCl lens (focal distance 1.8 m) formed an image on thermal sensitive material of our own making. The sensitivity of this sort of thermally sensitive material was higher than ordinary thermal paper and was suitable for recording pulsed CO_2 lasers. The spectrometer had a rather high resolution. The spacing of two adjacent lines in the recording material image was 3-4 mm. After calibration, the 10P lines of the CW CO_2 frequency selecting laser we used are shown in Figure 4. The image formed in the thermal sensitive material by the pulsed laser was rather large with a diameter of 4 mm. In order to avoid overlapping the images of different wavelengths, after each pulse illumination, the recording material was moved up 4 mm. This way we obtained the diagonal line shaped spectra of Figure 4.

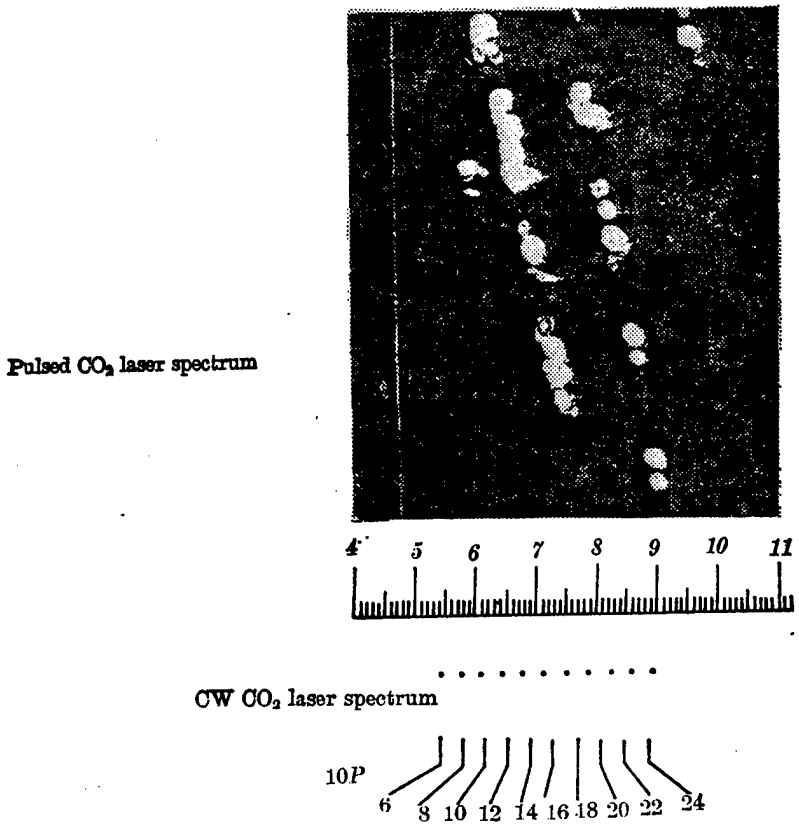


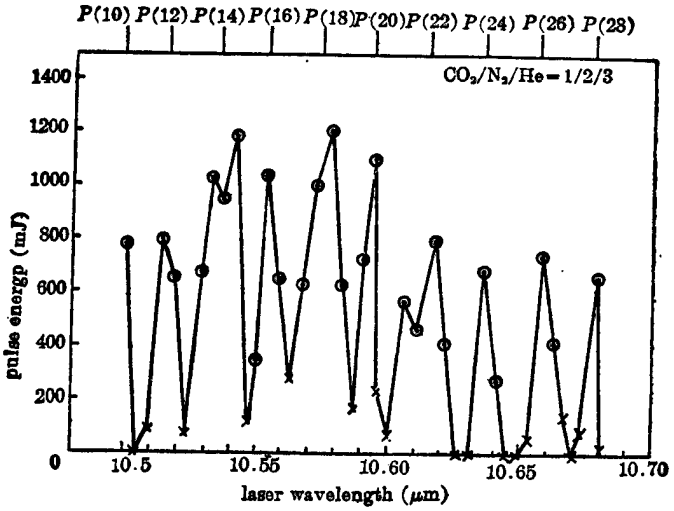
Figure 4. Pulsed CO_2 Laser Spectrum

During the experiment, each time the grating was rotated $\Delta\alpha = 0.02°$, the equivalent wave length variation $\Delta\lambda = 0.0044$ μm which was one-fifth the difference of adjacent lines. From the spectrograms it is evident that $\Delta\alpha$ and $\Delta\lambda$ are in direct proportion, in agreement with the results of Alimpiev et al. [8].

From Figure 4 we also see that when the grating is at certain positions there is no spectrum recorded but there is a reading on the energy meter. Possibly this is because the recording material has an energy threshold below which it cannot register any record.

In Figure 5, points which where recorded simultaneously by both the spectrometer and energy meter are indicated with a " ⊙ " and those recorded only by the energy meter are marked using an "X." At these times the corresponding wavelengths were computed from the angle of the grating rotation, $\Delta\alpha$.

From Figure 5 we see that when operating under 6 atmospheres, the CO_2 spectrum is rather wide. If we use Figure 5 to estimate the spectral line width we obtain a width of 30 GHz, that is 5 GHz/atm, identical to the data of Alcock et al. [2].



Electron gun voltage 234 kV Main discharge voltage 50 kV

Figure 5. Laser Energy Versus Wavelength

In Figure 5 it is evident that if we supplement with the energy meter readings, for a given discharge condition, from 10P(12) to 10P(22) is continuously tunable but the energy undulations are rather large making it unfit for application. Of course we can vary the parameters of the laser cavity or adjust the discharge conditions with a consequent expansion of the range of continuous frequency tuning. However, to get a smooth continuous frequency tunable laser also requires increased operating gas pressure. We are now engaged in study of CO_2 lasers at 10 atmospheres.

When designing the laser we received the assistance of Zhuang Dounan [8369 2435 0589] and Lu Zai [7120 6528] of the Chinese Academy of Sciences Shanghai Optics and Fine Mechanics Research Institute to whom we express our gratitude. Zhao Jun [6392 6874] and Wang Yibing [3869 0110 3521] also participated in this work. They both made beneficial contributions to the work.

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12966/6091
CSO: 4008/42

OBSERVATIONS AND ANALYSES OF SUMMER WHISTLERS AT THE GREAT WALL STATION OF ANTARCTICA

Beijing DIQIU WULI XUEBAO [ACTA GEOPHYSICA SINICA] in Chinese Vol 30 No 2, Mar 87 pp 109-118

[English abstract of article by He Changming [6320 7022 2494], et al., of the Institute of Geophysics, Chinese Academy of Sciences, Beijing]

[Text] During the First Chinese National Antarctic Research Expedition, whistler and VLF emission observations were carried out for 37 days. In the present paper the authors describe the observational instruments and circumstances. Based on statistical analyses of the observed data, whistler types, occurrence and dispersion characteristics of whistlers are described. Emphasis is placed on the detailed analysis of typical whistlers during and after a magnetic storm. The electron density variation corresponding to the propagation path is deduced. It is found that during the storm the depletion of the plasmasphere and the subsequent refilling process from the ionosphere occurs. The results show that the downward depletion flux is 10^9 el/cm^2·s and upward refilling flux is 5×10^8 el/cm^2·s.

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CSO: 4009/51

EVOLUTION OF ACOUSTIC GRAVITY WAVE PACKET IN SPATIALLY AND TEMPORALLY VARYING WIND

Beijing DIQIU WULI XUEBAO [ACTA GEOPHYSICA SINICA] in Chinese Vol 30 No 7, Mar 87 pp 119-127

[English abstract of article by Yi Fan [2496 1581] and Liang Baixian [2733 4102 0341] of the Department of Space Physics, Wuhan University; and Li Jun [2621 6874] of Wuhan Institute of Physics, Chinese Academy of Sciences]

[Text] Starting from compressible hydrodynamic equations and using the multiple scale and WKB methods, the authors have investigated the evolution process of an AGW packet in a spatially and temporally varying wind. The evolution equations of wavelength, phase velocity, propagation direction and amplitude of the AGW packet are derived. It is shown that the variations of wavelength, phase velocity and propagation direction depend on the spatial and temporal variation of the wind and also on the direction of the wave packet with respect to the wind. By analyzing the evolution equation of the amplitude, the authors found that the wave action of AGW is conserved in the spatially and temporally slowly varying wind. Further analysis shows that an increase in the packet energy is accompanied by an increase in the wave frequency, while a decrease in the packet energy is accompanied by a decrease in the wave frequency. The cause of the packet energy variation is wave-flow interaction produced by temporal variation of the wind.

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CSO: 4009/51

TEMPORAL EVOLUTION OF IONOSPHERIC ELECTRIC FIELD DRIVEN BY FIELD-ALIGNED CURRENT

Beijing DIQIU WULI XUEBAO [ACTA GEOPHYSICA SINICA] in Chinese Vol 30 No 7, Mar 87 pp 128-135

[English abstract of article by Guo Youmin [6753 0147 3046] of the Department of Geophysics, Beijing University]

[Text] Based on a simple Senior-Blanc's time-dependent model and using a step-varying field-aligned current instead of the potential as the driving force, the temporal evolution of the ionospheric electric field is discussed. It is shown that configurations in both cases are similar--the relaxation time toward the steady state is about 50 minutes in both cases. However, there are some differences between them: under current driving situations, the potential at the boundary of the polar cap is not constant but decreases exponentially toward the steady state; at the auroral zone the difference between the steady state and the initial time electric fields is very small. In addition, the steady state value of the second field-aligned current calculated from the model is even closer to the observed value. The latitudinal variation of the potential is steeper, and the maximum potential appears earlier. The calculated shielding factor and the shielding time constant show that the shielding effect under the current driving situation seems stronger than that in the potential driving case.

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CSO: 4009/51

CHARACTERISTICS OF SUBDUCTION ZONE BENEATH BURMESE ARC AND ITS STRESS STATE

Beijing DIQIU WULI XUEBAO [ACTA GEOPHYSICA SINICA] in Chinese Vol 30 No 7, Mar 87 pp 144-158

[English abstract of article by Zang Shaoxian [5258 4801 0341] of the Department of Geophysics, Beijing University]

[Text] The distribution of intermediate depth earthquakes in the area of the Burmese Arc has been studied using ISC data for 1965-1982. It is found that the earthquakes with depths more than 70 km mainly occurred in the region from 20°N to 26.5°N and formed a seismic belt. The distribution of the earthquakes has been studied in detail by examining seven profiles perpendicular to the seismic belt. This confirms the existence of the Benioff Zone beneath the Burmese Arc. The geometry of the Benioff Zone changes along the seismic belt. Its dip direction is eastward in the southern part from 24°N and gradually changes to nearly southeastward in the northern part. In both the southern and northern ends of the seismic belt the Benioff Zone is nearly straight with a smaller dip angle than that in the middle part of the belt, and it extends to the depth of 100 km. In the middle part of the seismic belt the dip angle of the Benioff Zone gradually increases with depth, and the zone itself extends to 180 km. In depths from 45 km to 100 km the double seismic zones appear on some profiles, with distances between the upper and lower zones differing in different profiles, varying from 10 km to 25 km.

The stress state on the subduction zone has been studied using fault plane solutions. It has been found that the P axes are distributed mainly in the azimuths from 210° to 270°, and the T axes do not have a predominant direction. The predominant direction of P axes for earthquakes in the crust is different from that for earthquakes on the subduction zone, suggesting that the direction of the compression stress in the crust rotates nearly 20° counterclockwise in relation to that on the subduction zone. The directions of the T axes on the upper seismic zone are coincident with the dip direction of the subduction zone.

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CSO: 4009/51

APPLICATION OF RANDOM TRANSFORMATION TO NON-CIRCULAR CROSS-SECTION PLASMA DIAGNOSTICS

Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 36 No 3, Mar 87 pp 275-283

[English abstract of article by Li Ding [2621 1353] of the University of Science and Technology of China, Hefei; Huo Yuping [7202 5940 1627] of the Institute of Plasma Physics, Chinese Academy of Sciences]

[Text] In this article, using the method of image reconstruction from the projection based on the theory of random transformation, a new way of determining simultaneously the magnetic configuration and two dimensional distribution of physical quantities of non-circular cross-section plasma from the diagnostic results is explored. Assuming that the distributions of the physical quantities depend only on the magnetic surface function and all the surfaces are similarly concentric, the authors propose three methods of treatment. For D-shaped plasma, the analytical treatment and numerical simulation are discussed in detail. An example of the determination of the magnetic configuration and electron temperature and density from soft X-ray and microwave interference measurements is demonstrated.

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CSO: 4009/49

SILICON FILM DEPOSITED BY LASER-PLASMA

Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 36 No 3, Mar 87 pp 293-300

[English abstract of article by Fu Guangsheng [0265 1639 3932], et al., of the Department of Physics, Hebei University, Beijing]

[Text] In this work the laser deposition process of Si thin film at low temperatures and under low pressure is studied. The authors have obtained both poly-crystalline and non-crystalline films of a few cm^2, and they are satisfactorily homogeneous. The optimum conditions for the deposition process have been carefully determined. When the pedestal temperature is 380°, poly-crystalline films are formed. Based on the model of the photo-breakdown of SiH_4 through resonant absorption of the laser and energetic Si-atom formation induced by the shock waves produced, the laser plasma CDV dynamic process is analyzed. The authors have found that the photo-breakdown of SiH_4 by the TEA CO_2 laser and the induced shock waves significantly influence the growth of the Si films. The sizes and crystalline structure of the Si films as calculated theoretically agree qualitatively with the experimental results.

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CSO: 4009/49

EXPERIMENTAL STUDIES OF EXCITED STATES IN COLLISIONS BETWEEN He^+ AND Ar

Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 36 No 3, Mar 87 pp 301-307

[English abstract of article by Pan Guangyan [3382 1639 3508], et al., of the Institute of Physics, Chinese Academy of Sciences]

[Text] An electron capture process and direct exciting process both occurred in collision between He^+ and Ar in the energy range of 70 to 150 keV. From a comparison of experimental results between He^++Ar and He^++Ne collision systems, the authors have noticed that the emission cross sections of the triplet HeI of the former are much larger than those of the latter when the velocity of the incident ion He^+ is small. The latter becomes larger than the former when the velocity of He^+ is greater than 1.0 a.u. (2.2×10^8 cm/s). Therefore, the potential energy defect and projectile velocity are very important factors in the electron capture process and there is competition between them in collisions.

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CSO: 4009/49

NEW CRITERION FOR SUPERCONDUCTIVITY OF ELEMENTS

Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 36 No 3, Mar 87
pp 357-362

[English abstract of article by Luo Qiguang [5012 2790 0342] of the Institute of Physics, Chinese Academy of Sciences; Wang Rongyao [3769 2837 5069] of the Department of Physics, Qinghua University]

[Text] This article presents a new criterion for superconductivity. It can be applied to all elements in the periodic table. The criterion shows that the values of electronegativity of all superconducting elements are concentrated in the narrow range from 1.3 to 1.9, and that the elements with values outside this region will be non-superconductive.

Thoroughly studying the relationship between electronegativity and superconductivity of elements will contribute to revealing the connection between the electron's electrostatic interaction with crystal lattices and superconductivity, which will aid further work on the mechanism of superconductivity.

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CSO: 4009/49

DAMAGE PHENOMENA OF INFRARED MATERIALS IRRADIATED BY INTENSE PULSED CO_2 LASER

Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 36 No 3, Mar 87 pp 386-390

[English abstract of article by Wang Chunkui [3769 2504 1145], et al., of the Institute of Mechanics, Chinese Academy of Sciences; Li Huining [2621 1920 1357], et al., of Beijing Designing Division for Electronic Engineering]

[Text] Experiments show that the damage to materials irradiated by an intense CO_2 laser can be divided into two types: ablation and shock wave damage. The ablation is dominant when the laser power density is lower than the air breakdown threshold. When the laser power density is higher than the breakdown threshold, the shock wave damage becomes prime. Under the authors' experimental conditions, when a strong laser beam irradiates on brittle targets, such as infrared window materials MgF_2, KCl, Ge, etc., small cracks or broken pieces are formed very easily. The damage is related to pulse energy, power density, pulse width and the irradiated area on the target. Photographs of radiation damage are also given.

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CSO: 4009/49

LOW FREQUENCY EFFECTS OF TRANSVERSE CONDUCTIVITY OF ELECTRONS IN LOCALIZED STATE OF TWO DIMENSIONAL ELECTRON GAS IN MOS INVERSION LAYER UNDER CONDITION OF QUANTIZED LIMIT

Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 36 No 4, Apr 87 pp 411-418

[English abstract of article by Zhao Lengzhu [6392 0397 2691] of the Department of Physics, Shanghai University of Science and Technology]

[Text] In this article the author analyzes the frequency characteristics of electron conductivity in localized states of the two-dimensional electron gas (2DEG) in the MOS inversion layer under conditions of the quantized limit.

Based on the frequency dependence of the Fermi distribution function, the author derives the frequency characteristics of the two dominant conduction processes, i.e., the conductivity due to the process of thermally exciting to the mobility edge, $\sigma_{ME}(\omega)$, and that due to the variable range hopping process, $\sigma_{VRH}(\omega)$. The authors conclude that $\sigma_{ME}(\omega)$ and $\sigma_{VRH}(\omega)$ are both complex functions. The time constant of $\sigma_{ME}(\omega)$, τ_n, is longer, corresponding to a low frequency process. That of $\sigma_{VRH}(\omega)$ is much shorter, corresponding to a high frequency process.

The theoretical curve is compared with the experimental data. It is found that in order to fit the theoretical curve to the experimental one, the time constant τ_n should be approximately 3.6×10^{-6} s.

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CSO: 4009/54

NON-EQUILIBRIUM DISTRIBUTION OF POPULATION OF ALKALI ATOMS IN GROUND STATE INDUCED BY LASER-MW DOUBLE RESONANCES

Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 36 No 4, Apr 87 pp 436-443

[English abstract of article by Chen Xiaoyuan [7115 1420 3293] and Zhu Xiwen [2612 3556 2429] of Wuhan Institute of Physics, Chinese Academy of Sciences]

[Text] The authors obtained the conditions under which the maximum non-equilibrium distribution of the population of alkali atoms in the ground state in an atomic beam pumped by laser-MW double resonance is achieved. These conditions are consistent with the results of recent experiments. The authors examined the processes affecting the realization of the non-equilibrium distribution of the population, and present the methods for eliminating the effects of these processes. The features of pumping processes with laser-MW double resonance are discussed and compared with the two laser pumping processes.

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CSO: 4009/54

SPONTANEOUS CURRENT GENERATED FROM LASER PLASMA

Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 36 No 4, Apr 87 pp 452-458

[English abstract of article by Wang Runwen [3769 3387 2429], et al., of Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] The authors studied the phenomena of spontaneous currents generated from laser plasma which was produced from several plane targets made from Rh, Ag and Cu irradiated with high power laser light. The pulse-width, output energy and wavelength of the laser were 200 ps (FWHM), 0.1-4 J and 1.06 μm, respectively. At the focal spot of the target irradiated with the laser, a spontaneous current density as high as 10^7 A/cm^2 was found in the experiment.

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DYNAMICS OF MULTIPHOTON IONIZATION OF ACETALDEHYDE BY UV LASER

Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 36 No 4, Apr 87 pp 459-466

[English abstract of article by Zhu Rong [2612 2837] of the Department of Physics, Zhongshan University; Han Jingcheng [7281 2529 6134], et al., of Anhui Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, Hefei]

[Text] In this article, the authors present the experimental results of a mass spectroscopic study of multiphoton ionized acetaldehyde molecules in the gaseous phase excited by an XeCl excimer laser under molecular beam conditions. Based on the linear relationships between the intensities of fragment ions and the pressure of sample gas, the authors show that the multiphoton ionization and fragmentation of acetaldehyde is a unimolecular reaction, revealing some of the photochemical behavior of acetaldehyde in the photolysis process by the ultraviolet laser. According to the MPI mass spectrum of acetaldehyde, the variation of intensities of the fragment ions in the MPI mass spectrum with laser power and the photophysical properties of its first excited single state $^1(n, \pi^*)$, the authors propose a parent dissociation-neutral fragment ionization model of MPI of acetaldehyde which is used to explain the experimental results.

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CSO: 4009/54

IMPROVEMENT OF QUANTITATIVE EDS ANALYSIS OF THIN FILMS BY MEASURING THE I(L)/I(K) INTENSITY RATIOS

Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 36 No 4, Apr 87 pp 473-482

[English abstract of article by Duan Jianzhong [3008 1696 0022], et al., of the Center of Fundamental Physics, University of Science and Technology of China, Hefei]

[Text] The intensity ratios I(L)/I(K) of eight kinds of pure element thin films from Ge to Sn have been measured in a TEM using X-ray EDS at 40, 80, 100, 120, 160 and 200 kV. Using these I(L)/I(K) values, the Cliff-Lorimer factor K_XSi and their interpolated values for the K lines, the K_XSi values for L lines are obtained.

In order to determine which Q ionization cross-section formula in the literature is the best, the calculated values I(L)/I(K) using nine formulas for Q are compared with the experimental data. It is found that there are large discrepancies between the experimental data and the calculated values. After considering the errors from various parameters used in the calculation, it becomes evident that the discrepancy is mainly caused by cross section inaccuracy, and the best Q formula, proposed by Fabre de la Ripelle, must also be revised. Quantitative analysis for several specimens with known compositions has been done using the revised Q and the EDAX-9100 programs. The results show that by using the revised Q formula, the errors of analytical results from K-K and K-L lines at 100 and 200 kV can be significantly reduced.

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CSO: 4009/54

EFFECT OF COMPOSITION ON CRYSTALLIZATION TEMPERATURE OF Fe-BASE AMORPHOUS ALLOYS

Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 36 No 4, Apr 87
pp 483-489

[English abstract of article by Che Guangcan [6508 1639 3503], et al., of the Institute of Physics, Chinese Academy of Sciences, Beijing]

[Text] In this paper the relationship between composition and crystallization temperatures of Fe-base amorphous alloys is investigated systematically. Among 95 Fe-base amorphous alloys, the crystallization temperatures of approximately 85 percent of them are in the range of 700-825 K, $T_{cr}/T_m \approx 1/2$ (0.42 - 0.62), and conform to Sakka's principle. The crystallization temperature of $Fe_{1-x}B_{x-y}Si_y$ is greater than that of $Fe_{1-x}B_x$, which is greater than that of $Fe_{1-x}B_{x-y}P_y$. Those mentioned above are discussed in reference to the composition, phase diagrams, mechanism of crystallization, diffusion and the relationship between the crystallization temperature and the average electron concentration (e/a).

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CSO: 4009/54

EXPERIMENTAL STUDIES ON LOW TEMPERATURE MAGNETISM OF $Gd_3Ga_{5-x}Al_xO_{12}$ SINGLE CRYSTAL

Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 36 No 4, Apr 87 pp 540-546

[English abstract of article by Liu Pinqing [0491 0756 3237] of the Cryogenics Laboratory, Chinese Academy of Sciences, Beijing]

[Text] A $Gd_3Ga_{5-x}Al_xO_{12}$ single crystal has been grown by the Czochralski technique. It has been ascertained as the parent single phase material by X-ray photography. Experimental studies of the magnetization and susceptibility of $Gd_3Ga_{5-x}Al_xO_{12}$ have been carried out along the [111] crystal axis in the temperature range of 1.5 to 77 K, and compared with those of $Gd_3Ga_5O_{12}$ (GGG). The primary results show that the susceptibility of this material obeys the Curie-Weiss law when the magnetic field is below 500 (Oe), and the ordering temperature is far below 1.5 K. The magnetization of GGAG is about 4 percent higher than that of GGG for magnetic fields greater than 10,000 (Oe). When the magnetic field is about 30,000 (Oe), the critical magnetic field is GGAG is about 4000 (Oe) higher than that of GGG. It is shown that the substitution technique is efficient in searching for new working substances for magnetic refrigerators.

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CSO: 4009/54

BRIEFS

ELECTRON-BEAM ACCELERATOR TEST--A relativistic high-current electron-beam accelerator manufactured by the Department of Applied Physics under the University of Science and Technology for National Defense, recently passed a miniserial-level test in Changsha. The high-current electron-beam technology is a high technology developed in the 1970's. The electron-beam accelerator is an important experimental facility for producing high-current electron beams. [Excerpts] [Changsha Hunan Provincial Service in Mandarin 1000 GMT 21 May 87 HK] /12858

CSO: 4010/49

OFFICIAL SAYS 'EL NINO' AFFECTS CHINA'S OCEAN ENVIRONMENT

OW221244 Beijing XINHUA in English 1216 GMT 22 May 87

[Text] Beijing, 22 May (XINHUA)--The "El Nino" phenomenon is seen to affect China's ocean environment soon, according to China's State Bureau of Oceanography.

At a press conference today, Yan Hongmu, director of the State Bureau of Oceanography, marine physicist Wang Zongshan and meteorologist Chao Jiping explained the situation.

The so-called "El Nino" is a term referring to a natural phenomenon in which the water temperature in the East Pacific Ocean rises sharply, causing an alarming death toll among plankton, fish and sea birds. It alos affects the global weather. The reason for the phenomenon is still not clear, the Chinese scientists said.

During joint surveys of the tropical Western Pacific Ocean between December 1985 and February 1986, and November 1986 to February 1987, Chinese and American scientists observed abnormal phenomena in marine meteorology, physics, biology, and chemistry over a wide range of the Western Pacific.

Chinese scientists predicted that a new "El Nino" was forming and will influence China's ocean environment.

Professor Chao Jiping said that lower than usual temperatures and more ice are expected in North China's Bohai Sea this winter. Meanwhile, the sea surface temperature of the continental shelf to the north and west of the Kuroshio current will rise. The Northwest Pacific will have less typhoons.

Also, as a result, North China will have more rain this year and the volume of river flow to the sea will also increase, which will be favorable to the growth of prawns and shrimp in the Yellow and Bohai seas.

Wang Zongshan said that China plans to conduct another survey this September, when "El Nino" abates, to gather further data on the phenomenon.

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CSO: 4010/49

UNIVERSITIES TRY TO MARKET S&T ACHIEVEMENTS IN HONG KONG

Beijing KEJI RIBAO in Chinese 17 Feb 87 p 1

[Article by reporter Li Jing [2621 0352]: "Open a Domestic Scientific Research Results Window to Hong Kong Industry; Universities to Go To Hong Kong to Hold Science and Technology Results Presentation Meeting"]

[Text] A "Key Chinese University Science and Technology Results Hong Kong Presentation Meeting" jointly held by the Chinese Higher Education Joint Development Center and the Hong Kong Trade Development Bureau will be held in Hong Kong on 18 February.

This is the first organized presentation in Hong Kong of scientific research results by Chinese universities. The presentation will display over 250 scientific research results to the Hong Kong industrial world through pictures, materials, artifacts, and on-the-spot operational demonstrations.

Most of the universities selected by the State Education Commission to participate in the Hong Kong Presentation are well-known in China and abroad. They were: Qinghua University, Beijing University, Beijing Normal University, Beijing Aeronautical University, Nankai University, Zhejiang University, Nanjing University, Zhongshan University, Xiamen University, Fudan University, Shanghai Jiaotong University, Xi'an University, Huanan Engineering College, and Huazhong Engineering College. The results exhibited by these schools will display the level of scientific research in Chinese higher schools and also have practical and commercial nature, and transactions for many of the results are hoped to be concluded at the meeting. For example, "Titanium Plate and Titanium Plated Layer Color Pictures" developed by the Engineering Physics Department of Qinghua University does not use tray color mixing, but requires only an electric pen dipped in an electrolytic solution to be able to draw colorful, beautiful, and bright pictures on titanium plate, the surface effect joins lacquer painting and cloisonne into one, and may be rated as blending the cream of Chinese and Western painting into one beautiful handicraft. Since it has broad application possibilities in such areas as jewelry, handicraft arts, and building decoration, it is estimated that it will become popular item in technology transfer for Hong Kong

commercial competitive demands. Fudan University's omnidirectional microwave anti-theft warning system and far-infrared qigong information treatment device, Nankai University's heavy metal waste-water ion exchange treatment technology and self-cooling CO_2 cosmetic machine, Zhejiang University's computer drawing system, and Huazhong Engineering College's harmonic wave started electric motor all may arouse interest among Hong Kong merchants.

At this presentation meeting, relevant persons from the Hong Kong business world will negotiate entrusting to Chinese universities such work as carrying out on their behalf industrial research and utilizing the results of scientific research in Hong Kong or in cooperative production in China. According to revelations of relevant persons in the Hong Kong Trade Development Bureau, Hong Kong will also continue to hold similar Chinese science research results presentations so that Hong Kong and China can each give play to their own superiorities and improve product quality and develop multi-element of on-the-spot industries by China with help from Hong Kong.

8226/9604
CSO: 4008/2078

BEIJING VACUUM PHYSICS LABORATORY OPENED TO FOREIGNERS

Beijing KEJI RIBAO in Chinese 14 Mar 87 p 1

[Article by Huang Yong [7806 0516]: "Open Laboratory of Chinese Academy of Sciences Shows Initial Success"]

[Text] The vacuum physics laboratory of the Chinese Academy of Sciences in Beijing has made 17 research achievements since it was opened to the public including foreigners in July 1985. Among these achievements are the new theory of the structure of molecular exhaustion, initiated by this laboratory, which were hitherto under study in the field of molecular exhaustion and new to the world. The laboratory has also developed a new type of molecular pump which puts China in a leading position in this type of research among other countries.

The Beijing Vacuum Physics Laboratory is among the first group of laboratories of the Chinese Academy of Sciences that are open to foreigners. Its main occupation is basic research in vacuum science and its application. A special system of funding is adopted for its monographic work. These funds are mainly allocated by the Chinese Academy of Sciences, although some come from other sources. Scientists engaged in vacuum science or in overlapping research projects at home and abroad may come to this laboratory to conduct scientific research provided their application has been evaluated by their peers and approved by the academic committee. They may also apply for cooperative research. Researchers at home and abroad may bring their projects and funds to work in this laboratory.

The academic committee of this laboratory is formed of 12 well-known Chinese and foreign vacuum physicists. Three of them are foreign scholars, and another three belong to the Chinese Academy of Sciences. The academic committee regularly comes to the laboratory to provide the necessary guidance. It examines the applications and evaluates the research results through democratic discussions and unnamed votes. A two-thirds majority vote is required for approval.

The laboratory has 44 research workers, among whom 35, or 80 percent, are guest researchers. The regular research personnel are all employed under 1- to 2-year contracts notarized by the Beijing Municipal Notary Public. The continuance or discontinuance of their service will be decided according to

their work performance upon the expiration of contract. The outstanding young researchers on the regular staff will be selected for advanced training by the laboratory. Outstanding guest researchers may, in exceptional cases, be employed by the laboratory to fill even higher technical posts. Thus many outstanding researchers are induced to work together for this laboratory.

This laboratory attaches very great importance to academic exchanges with foreign countries. Scholars from the United States, Japan, and some other countries have frequently come here to conduct research. Of the 19 research projects now being undertaken, 5 are conducted through international cooperation.

9411
CSO: 4008/2090

ACADEMY TACKLING KEY SEVENTH 5-YEAR PLAN PROBLEMS

Beijing KEJI RIBAO in Chinese 10 Mar 87 p 1

[Text] According to a news report of KEXUE BAO, by the end of 1986, the Chinese Academy of Sciences had already undertaken 47 major projects, 140 subprojects, and 522 monographic projects in the state's Seventh 5-Year Plan. About 7,000 S&T personnel from 109 units in the academy took part in this undertaking.

The methods used by the Chinese Academy of Sciences to tackle these problems were as follows:

1. Providing more active organizational leadership. The leaders of the academy personally attended to the work of "biotechnology" and "development of remote-sensing technology" which are among the projects of the first department in charge. They formed small leading groups and did everything possible to mobilize all available talents of science and technology for the solution of key problems.

2. Giving prominence to key projects. To take advantage of its special characteristics and favorable conditions, the academy was guided by the following principle in the choice of key projects: The projects should help the state solve important problems during the Seventh 5-Year Plan (with regard to important economic results, social benefits, and S&T progress.) For these projects, the academy should have the advantages of a strong S&T work force, good facilities for experiments, good leaders, and a powerful organizational leadership for the research institutes. These projects should also leave the academy the required reserve strength to continue the same task during the Eighth 5-Year Plan.

3. Bringing into play the superiority of unity through better cooperation and coordination in the academy. While planning to tackle the key problems of the Seventh 5-Year Plan, attention was paid to the superiority of the academy's comprehensive facilities with many different disciplines. At the same time, good external cooperation and coordination were maintained in order to form a "chain process" of scientific research, capital construction, intermediate tests, importation, and going into operation.

4. Setting up research and exploitation bases and building a backbone force for key problems. In the trial manufacture of nitrogen-hydrogen separation membranes, for example, comprehensive arrangements were made for research, development, intermediate tests, and small-batch production in addition to the work process, application, exploitation, and supplementary projects of the plant. Efforts were also made to coordinate all these jobs with industrial experiments. As a result, a cluster of bases with Dalian Chemistry and Physics Research Institute as the core was formed, and the foundation was laid for a newly emerging industry.

5. Paying attention to in-depth development and keeping a technological reserve as a foundation for the Eighth 5-Year Plan. In administration, due consideration was given to the need for the in-depth development of science and technology and for technological reserve. Some research of a basic nature--such as research for improving the technology of gene synthesis, research in Escherichia coli, subtilin, yeast, vaccine toxin, insects, and other items of the genetic engineering system--was conducted during the research in "biotechnology" so as to lay a foundation for genetic engineering of the next 10 years.

9411
CSO: 4008/2089

10 MAJOR TASKS FOR CHINESE ACADEMY OF SCIENCES IN 1987

Beijing KEJI RIBAO in Chinese 11 Mar 87 P 1

[Article by Du Mingming [2620 2494 2494] and Huang Yong [7806 0516]: "Chinese Academy of Sciences Planning 10 Major Tasks for Current Year"]

[Text] Zhou Guangzhao [0719 0342 0664], president of the Chinese Academy of Sciences, held a work conference in the academy on 10 March. Ten major tasks were planned for the academy in the current year, according to his report at the conference.

He said: To organize its main force to work in the main national economic sector and its vanguard to continue its climb to the top of world sciences, the Chinese Academy of Sciences must conscientiously tackle the state's key problems this year. It will selectively support a number of new technology exploitation companies (groups) or integrated bodies in selling their products on the international market; form a systematic network of facilities for natural resources, environment, ecology, major agriculture, and social welfare; strengthen its support for basic research in key projects so as to streamline the work of strategic research and the layout of different disciplines; and continue to make the S&T universities a success. This year, the academy will open up a number of research laboratories, establish and complete four key laboratories of the state, and organize the building of four other state laboratories with accelerators as their main engines. It will also strengthen its leadership so as to improve the ideology and workstyle of the leading bodies of its offices and basic units. A system will be established whereby the institute director will set his objectives during his term of office. Lateral ties will be further strengthened, and new systems and methods should be explored for cooperation with other departments, enterprises, localities, and institutes of higher learning. All branch academies should willingly accept the leadership of the local governments according to the requirements for the reform. This year, the branch academies in Kunming and Shenyang may be used as experimental units so that we may benefit from their experiences. The funding association for the promotion of science and technology and for economic development, founded jointly by the Chinese Academy of Sciences and the State Economic Commission, will support the units and enterprises jointly undertaking S&T work, and the support will be given in the form of full interest, subsidized interest, or interest-free loans, or risk investments. It will strongly uphold the policies of

increasing production and practicing economy, and increasing revenues and curtailing expenditures; firmly implement the decision to reform the system of fund allocation; and intensify the reform of the second line. It will open new channels of international cooperation, raise the standards of such cooperation, uphold the four cardinal principles, and strengthen socialist spiritual civilization.

9411
CSO: 4008/2089

CHINESE ACADEMY OF SCIENCES REFORM PROGRESS

Beijing KEJI RIBAO in Chinese 11 March 87 p 1

[Article by Du Mingming [2620 2494 2494]: "Intensified Reform in Chinese Academy of Sciences Makes New Progress"]

[Text] To keep pace with the rapid development in the technology of the photoelectronic industry in the world, six optics research institutes of the Chinese Academy of Sciences will become scientific research and production enterprises (companies). Other qualified enterprises will be invited to join them to form a photoelectronics company group, so that the work of research, development, production, and trading of commodities will all combine to serve a new photoelectronics industry and to make it strongly competitive in the world market. This is a new step in the intensive reform being carried out in the Chinese Academy of Sciences.

The development of photoelectronic technology touches on many fields, including modern optics, electronics, computer technology, photodetection, laser, light-wave communications, and optical computer technology. The rapid development of this technology is mainly attributed to the close relationship between technology and production. The developed countries of the world are now quickly developing the technology-intensive industry of optics and electronics. It is estimated that the total sales of photoelectronic products will equal that of electronic products by the turn of the century. In the scramble for the future world market, the United States, the Soviet Union, Japan, and Western Europe will give high priority to the expansion of the photoelectronic industry.

China's photoelectronic industry has not yet taken shape. However, the Chinese Academy of Sciences has a strong contingent of optics and electronics scientists. Since 1952, this academy has established optics and fine mechanics institutes in Changchun, Xian, Shanghai, Anhui, and Chengdu in addition to the Technical Physics Institute in Shanghai. These six institutes have nearly 10,000 workers and staff members. The number of S&T personnel exceeds 4,300 (including 675 high- and intermediate-grade researchers). Furthermore, each of these institutes has its own factory. For 30 years, they have done a great deal of pioneering work in the traditional optic, laser, Infrared, and photoelectronic technologies, and made great contributions to national defense. Some of their basic research is also approaching advanced

world standards. Because of the restrictions from the old system, however, research was divorced from production, and many research achievements could not become commodities. The potential of research could not be fully utilized.

Now, the Chinese Academy of Sciences has decided to reform the old system. The main features of this reform program are as follows:

--The six research institutes will become companies, and retain their original brand names. The structures of the companies will be thoroughly transformed into scientific research, production, and business entities operating according to market demands and with the organization of commodity production as their goal. There will be a combination of technology, industry, and foreign trade. The companies will analyze and forecast market demands, select the correct research and development projects, and practice commercial production as soon as possible in order to supply fine-quality, technology-intensive, and easily marketable commodities as well as substitutes for imported goods.

--The companies will consist of research, development, production, marketing, and service departments. They will also have full authority for management, practice independent accounting, and gradually assume responsibility for their own profits and losses. The system of managers assuming full responsibility will be adopted.

--The companies will actively undertake the state's important projects and other large research projects of an infrastructural nature and operate open laboratories in order to increase the competitive power of their products in the international photoelectronic field.

--They should strengthen their integration with the relevant industrial enterprises and serve the technological transformation and development of the trades concerned. They should also play an active part in the local economic activities.

--They should organize the preparations for establishing a company group. With the six optics and fine mechanics companies taking the lead, we should invite other enterprises to join the company group, which will absorb domestic and foreign funds and become export-oriented. This company group will enjoy the status of legal entity under the system of a president assuming full responsibility under a board of directors. It will be primarily concerned with the development of new products and opening new markets, and regard the research, exploitation, production, manufacture, and marketing of photoelectronic products and the related services as its overall undertaking. It will also assist in the technological transformation of the communications, transportation, chemical, and textile industries, and metallurgy trades and to serve medical treatment, public hygiene, education, and national defense.

9411
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ACADEMY OF SCIENCES OFFICIALS DISCUSS REFORM MEASURES

Beijing KEJI RIBAO in Chinese 13 Mar 87 p 2

[Text] The Chinese Academy of Sciences has decided to plan for the next step in its reform on the basis of the requirements for national economic development and its own realities. Recently, the officials of some of its research institutes and the development companies presented their views on the reform.

Conduct Reform in an Active and Independent Spirit

Sang Yixiu [2718 3015 0208], party committee secretary of the Hydrobiology Institute, Wuhan, said: Since last year, many views on the reform have been expressed and the institute was under heavy pressure. The leadership of the institute has thought of many plans, but very rarely conducted the reform actively and independently. After reading the academy's reform plan, our misunderstanding was removed, and our confidence in the reform and our determination to conduct it were strengthened. Reform is not only urgently needed for tne national economic development, but also unavoidable for its own technological development. Therefore, we must enhance our understanding of the reform and conduct it actively.

Hu Hongjun [5170 7703 6874], director of the Botany Institute, Wuhan, said: The S&T development of a country must be based on economy. This concept must be upheld. The state should consider the real economic difficulties of the academy, but the academy should also understand the state's predicament. It should enter the main battlefield and be oriented to economic construction. This will be helpful to the long-range plans of development for the state, the people, and science and technology.

Zhang Jihuai [1728 0679 2849], party committee secretary of the Rock and Soil Mechanics Institute, Wuhan, said: In recent years, we have done a great deal of work in mine construction, water conservation engineering, and energy and transportation projects. Our income from lateral sources and our operating expenditures are basically half-to-half, and the research institute continued to develop vigorously. The economic departments are satisfied with our performance. As we understand, the crucial factor in the success or failure

of the reform is our willingness or unwillingness to conduct it. There must be willingness before the reform can have its innate driving force for practical results.

Shi Limin [2457 4539 3046], Zoology Institute, Kunming, said: In the past, we always felt important and superior. We wanted preferential treatment not only from the state to the academy, but also from the academy to us. We now realize that this is improper. We should not place our hopes on preferential treatment, but should rather rely on our own efforts, if we want to develop our research institute. We must rely on our own contributions, if we want to win social recognition and support.

Pioneering Undertaking Requires New Value Concept

Yang Renguang [2799 0088 0342], manager of the Baopo Co said: In the past, the institute's work was mainly confined to the reading and writing of articles, and the value of the articles was determined by the appreciation of authoritative people. The fruits of labor were generally expressed in the form of theses and could hardly become productive forces. Therefore, this traditional concept must be changed. Our company is now concerned not only with making money, but also with starting a new undertaking. Each year, our company with slightly more than a dozen people makes a profit of more than 1 million yuan, and many people want to work in this company. But they have worries mainly because of the many biased views against the company. If the academy wants to blaze a trail for the combination of scientific research with production, the unity of thinking and understanding is very important. There must be a change in the way of thinking and the establishment of a new value concept.

Chen Qingzhen [7115 1987 2182], general manager of the Kehai Co, said: In the past, the academy evaluated its S&T personnel mainly according to their theses on which, their promotion, upgrading, and housing allocation depended. This policy of measuring the standards and contributions of S&T personnel dampened their enthusiasm. The personnel from the academy working in "Kehai" are not of the top professional level. However, they work very hard and show great enthusiasm, and their average annual labor productivity is about 100,000 yuan. The main cause of this fine performance is that the company evaluates them according to their actual work, so that they could fully display their ability.

Create Conditions for Founding Advanced Technology Industry

Tu Yan [1458 3543], general manager of the Keli Co, said: Advanced technology industry cannot be produced from China's traditional industry; it can only be produced and developed in places where the S&T work force is strong. This is determined by the nature of advanced technology products. These intelligence-intensive and technology-intensive products are beyond the capability of traditional industries. If the advanced technology products want to fight their way into the world market, they must first establish a firm foothold in the country and develop to a certain level; otherwise they cannot compete with others in the world market. Our academy should work out an overall plan to create the necessary conditions for such an advanced technology industry to be set up.

Guan Dinghua [7070 1353 5478], director of the Acoustics Institute, said: With its huge S&T work force and its high intellectual standards, the academy should establish its own advanced technology enterprises or advanced technology group. For basic research, the Acoustics Institute has to choose its projects and personnel very carefully, and the operational mechanism remains basically unchanged. For the development of new technologies, however, the operational mechanism has to be changed. We should also attach primary importance to the users' requirements and manufacture whatever is in demand on the market.

Strengthen Personnel Training, Promote Personnel Flow

Yang Le [2799 2867], director of the Mathematics Institute, said: In basic theory research, we are confronted with an important question. In 5 to 10 years later, will the young people as our reinforcements be able to keep up the same, or do even more work in the S&T field? This concerns the task of recruiting and training young people in scientific research. Under present conditions, those having obtained their doctoral degree should be eligible for recruitment, selection, and training. If this method is adopted, we may be more flexible with the standards for admission. After a certain period, we will decide on whether they should be retained in the same unit or sent to other units on exchange, according to the conditions of work and our requirements. By this means, we can be more flexible in the recruitment and use of talents.

Zhou Mingtao [0719 2494 7118], general manager of the Xiwan Co, said: Companies are more flexible than research institutes, but they are not without problems. We now have two earnest hopes. First, we hope tne academy will work out an overall plan and a clearcut policy for the company's development; and second, we hope the problem of personnel flow between the company and the institute will be rationally solved. Otherwise, the company will have to compete with the institute for talents resulting in contradictions between them.

Li Qibin [2621 0796 2430], observatory director, said: The academy has rich resources for basic research, but the work force is not highly trained. The personnel to engage in basic research must be carefully selected, so that they may be capable of winning international awards. Otherwise the existence of a basic research work force in the academy would be of no great significance.

Sun Shu [1327 2873], director of the Geology Institute, said: More than half of our S&T personnel are engaging in basic research, and scientific research funds accounts for 25 percent of the total funds. At present, the workload for most of our research personnel has reached the saturation point, and the personnel have done a great deal of work for the state's important engineering projects. We will continue to undertake the state's important projects in the future, and at the same time, step up our work in basic theory research and open more laboratories in the hope that our institute will be turned into an open mobile base for the development of geological research.

Need for Coordinated Policies and Specific Measures

Xu Houze [6079 0624 3419], director of the Surveying and Geophysics Institute, Wuhan, said: The ideology behind the plan for the academy's reform is clear, but the coordinated policies and specific measures must be commensurate with it. For example, how should we reward those comrades who have successfully popularized and developed some research achievements? These comrades should be better paid. However, the present rigid restriction dampens their enthusiasm. Furthermore, to establish an advanced technology industry for the academy, we should consider risk investment, which is, however, not permitted according to present policies. This problem should be carefully studied and solved.

Ran Zongzhi [0373 1350 2784], president of the Wuhan Branch Academy, said: There should be new forms of coordinated policies for S&T personnel at various levels. For those engaged in basic research and development, there should be different criteria for promotion, upgrading, and rewards. This will have a positive effect in encouraging these personnel to enter the main battlefields and in promoting the flow of personnel.

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GUO SHUYAN ON RESULTS OF S&T REFORMS

Beijing RENMIN RIBAO OVERSEAS EDITION in Chinese 7 Mar 87 p 4

[Article by reporter Kong Xiaoning [1313 2556 1337]: "Guo Shuyan Talks About Results of S&T Organization Reform; China's S&T Development Is In the Ascendant; The State Will Adopt Measures to Encourage Workers and Farmers to Study Technology Intensively"]

[Text] While China is currently taking full advantage of intellectuals, the state will adopt relevant measures to encourage the broad working and farming masses to study technology intensively and develop initiative and creativity in their own occupations. Guo Shuyan [6753 2885 6056], deputy chairman of the State Science and Technology Commission revealed at the Chinese Science Association Rural Science Popularization Work Conference and Rural Science and Technology Enrichment Expert Experience Exchange Meeting held yesterday. In his speech, Guo Shuyan also introduced the results obtained in the transformation of China's science and technology system since last year. He said that since last year, the transformation of China's science and technology system has made definite progress. Except for individual departments, the new science and technology funds allocation system has gone into effect nationwide, with the average reduction of 10 percent in scientific research expenses nationwide last year promoting the development of lateral alliances of research and production. Last year the volume of technology transferred nationwide reached 21.06 billion yuan.

What is even more significant is that the transformation of the science and technology system has already stimulated a change in social ideology. The idea of scientific research being oriented towards economic construction has struck root in the hearts of people on the science and technology front.

Guo Shuyan emphasized that the emphasis of this year's transformation of science and technology system is to enliven scientific research agencies and science and technology personnel.

Currently, departments of China's State Council and the Chinese Academy of Sciences has established 1,005 independent research and development agencies, making up 20 percent of the total number of research and development agencies above county level nationwide and encompassing 65 percent of the number of scientists and engineers. Relatively more of the science and technology mainstays among them have never been fully utilized. Guo Shuyan said that invigorating these scientific research agencies is the emphasis of the next task in the transformation of the science and technology system.

The materials provided by last year's science and technology survey indicate that only more than 1,900 of the more than 6,000 large and medium industrial enterprises in China have technology development agencies. Technological personnel in the light industry system make up only 0.8 percent of the total number of employees. Rural enterprise technology personnel are even rarer. Guo Shuyan feels that an effective method of resolving this problem is to encourage enterprises to ally closely with existing independent institutes or absorb them into the enterprise and encourage rational movement of science and technology personnel, especially to contract positions in rural enterprises.

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ZENG XIANLIN DISCUSSES S&T REFORM

Beijing KEJI RIBAO in Chinese 22 Mar 87 p 1

[Article by Li Renqin [2621 0088 6024] and Han Wangqi [7281 3769 3825]: "Zeng Xianlin [2582 2009 2651] on Guiding Thought for Promoting Science and Technology Reform"]

[Text] "The guiding thought for implementing the policy of "freeing the scientific research organs and scientific research personnel" and further promoting the reform of the science and technology structure is to be "active, cautious, and investigative." These remarks were made by Zeng Xianlin, vice minister of the State Science and Technology Commission [SSTC], when he listened to the reports of the investigation groups, organized by the SSTC and other units, on 18 and 19 March. These investigation groups had returned to Beijing after visiting Jiangsu, Hubei, Sichuan, and northeast China.

As to how the conditions now confronting the reform should be viewed, he said: The two important documents--"Certain Regulations Concerning Further Reforming the Science and Technology Structure" and "Regulations Concerning the Entry of Scientific Research and Design Units Into Large and Medium-Size Enterprises"--promulgated by the State Council have caused great repercussions in the ministries and commissions of the central government, the provinces, autonomous regions, and municipalities directly under the central government. The broad masses of S&T personnel strongly support this policy, and many people evaluate it very highly. However, the leadership of some departments, provinces, and municipalities do not clearly understand these two documents and respond to them with little enthusiasm. Some leading comrades have not even studied them. The enterprises are not warmly receptive to the policy of freeing the scientific research organs and science and technology because most of them are not ready for the "entry" of scientific research units. Some S&T policies lack supportive policies, and we must continue to do work diligently and meticulously.

Speaking of the guiding thought and requirements for future work, Zeng Xianlin said: We must be active, cautious, and investigative. At present, our main task is to conduct experimental reforms of different types and at different levels. To be cautious, as we said, does not mean waiting passively for something to happen. We must conduct active investigations, and after investigating and studying certain units, we must explore some new way. Thus

we can avoid a general rush. However, there should not be too many experimental units.

Zeng Xianlin mentioned some difficulties encountered in the current reform. He said: Sending research institutes down to the basic levels may not produce any immediate effect, and we may even encounter difficulties. The reform itself touches on the issue of redistribution of rights and interests. Sending research institutes down to basic levels may be more difficult than sending enterprises, but this is our orientation and cannot be changed. At present, the enterprises may not be in urgent need of technology, but the importance of science and technology to them is beyond question. They can produce good economic results and turn out fine-quality products only when they have made progress in science and technology. Of course, their need for technology has to go through a gradual process. In changing their old concepts into new ones, people also have to take time. Some units have their misgivings, but the central authorities have reiterated that the reform must continue.

Zheng Xianlin fully affirmed the work of the investigation groups jointly organized by the Science and Technology Leading Group of the State Council, the State Restructuring of the Economic System Commission, the NDSTIC, the Ministry of Agriculture, Animal Husbandry, and Fishery, and the SSTC, to conduct investigations at the basic levels. These investigations, as he believed, could provide us first-hand materials, enrich our minds, and keep us in closer touch with reality. This should be of practical significance to us in our next step in work and in our preparation of the supplementary documents.

9411
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CITIES DESIGNATED FOR S&T SYSTEM REFORM TESTS

OW011247 Beijing Domestic Service in Mandarin 0930 GMT 26 May 87

[Text] The State Science and Technology Commission, the State Economic Commission, the State Commission for Restructuring the Economic System, the Commission of Science, Technology, and Industry for National Defense, and the General Office of the Science and Technology Leading Group of the State Council recently made a joint decision to agree to designate Nanjing, Harbin, Guangzhou, and Huangshi as experimental cities for reforming the science and technology system. The decision also concurs in principle in the experimental plans proposed by these four cities.

The State Science and Technology Commission and the other units pointed out that two key tasks should be grasped in reforming the science and technology system in cities; that is, to alleviate the control over science and technology research organizations and carry out a more flexible policy on scientific and technical personnel and to further implement the strategic principle that economic construction must depend on science and technology while the work of science and technology must be geared to the needs of economic construction. They hoped that the four cities would implement the guiding principle of making active and prudent exploration in conducting their experimental work and steadily develop the work in depth so as to play an exemplary and leading role in promoting the reform of the science and technology system nationwide.

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CSO: 4008/67

SHANDONG S&T ORGANIZATION REFORM

Beijing KEJI RIBAO in Chinese 18 Feb 87 p 1

[Article by correspondents Sun Chengshu [1327 2052 1859] and Li Sen [2651 2773] and reporter Xu Shanbin [6079 0810 2430]: "'Weaning' and 'Reducing Milk' Will Not Influence Scientific Research Development and Growth; Shandong Scientific Research Agencies Develop in Transformation"]

[Text] In the past year, Shandong Province scientific research units have universally reflected the shortage of scientific research expenses, yet the scientific research topics have shown a tendency to increase, with the 58 scientific research units subordinate to the province accepting a total of 825 topics, a 10 percent increase over 1985; the 15 transformation test units designated by the province were "weaned" and "had milk reduced" earliest but the number of topics for 1986 increased by 12 percent over 1985. The pressure brought along by the reform of the scientific research funds allocation system has been turned into motive power and produced a new vitality in scientific research organizations.

The reduction of scientific research expenses accelerated the pace of scientific research organization reform and brought four major changes to scientific research agencies: First is it broadened the realm of technological service and improved self-consciousness of selecting topics with a view to economic construction. Last year the Provincial Metallurgy Institute's service projects for metallurgy enterprises were 18, but enterprise service projects outside the metallurgy industry numbered 72, fourfold more than for their own industry. After the Provincial Construction Institute expanded its scope of service, last year seven projects passed appraisal, an increase of five over the previous year, three of which filled domestic gaps. Second is that there have been new developments in combining scientific research and production. There are 385 existing joint research and production organizations in the province, 243 of which are long term close associations. The Provincial Metallurgy Institute established a joint research and production entity with the Taishan Industrial Company in Jinan to produce drills for use in mining so that an originally small plant with simple and crude equipment earned over 100,000 yuan in profit last year. Third is that the cycle of converting research results into productive forces has shortened. In May of last year a

Provincial Science and Technology Results Trade Meeting was held in Laixi County. Forty-three scientific research units brought 104 science and technology results and after negotiation, agreements were concluded on 101 of them, with a trade volume of 920,000 yuan. The Provincial Chemistry Institute transferred its science and technology results directly into the production shop and last year netted 340,000 yuan. Fourth is that the tendency for orientation towards medium and small enterprises and small town enterprises is growing. To find a comprehensive use for prickly ash oil, the Qingdao Chemical Industry Institute helped Yaoguanxiang in Laixi County start a paint plant and invested 200,000 yuan. The plant was constructed and went into production that year with a value of production reaching 2 million yuan, resolving very well the problem of utilization of local resources. Last year the provincial Academy of Sciences signed technology transfer contracts with medium and small enterprises and small town enterprises for 179 items, with the contract amount reaching 3.66 million yuan.

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CSO: 4008/2078

LABORATORY JOINTLY RUN BY ACADEMY OF SCIENCES, ENTERPRISE

Beijing KEJI RIBAO in Chinese 12 Mar 87 p 1

[Article by Zheng Haining [6744 3189 1337]: "Electrical Engineering Institute of Chinese Academy of Sciences and 'Kehai' Jointly Run Laboratory"]

[Text] The Electrical Engineering Institute of the Chinese Academy of Sciences and a collectively owned enterprise engaging in science and technology called the "Kehai Center for Combined Development of New Technology" jointly established an MCS laboratory in June 1985. Since its inception, this laboratory has popularized 22 research achievements. Many of these achievements reached advanced national standards, and five of them won awards for S&T advancement separately from the state, the Chinese Academy of Sciences, and Haiding District of Beijing. In 1986, this laboratory with only 16 persons made a profit of 1 million yuan--averaging more than 60,000 yuan per person. Its accomplished task was equivalent to that of a municipal-level research institute, and its profits was equivalent to that of a medium-size enterprise.

MCS is an abbreviation for mechanical control and microcomputer control system. The predecessor of MCS Laboratory was Group 506 of the Electrical Engineering Institute. This group was oriented to the application of microcomputers in industrial automation, and had produced some good results. However, it could not popularize its results and ran into financial difficulties, while its personnel were also gradually aging. That was why it was never able to become a strong work force. When "Kehai" was founded in May 1983, Group 506 joined forces with it and proceeded to transform the achievements of scientific research into direct productive forces. Through "Kehai," the laboratory imported microcomputers to be used as carriers and popularized the results of microcomputer applications with good economic results. In 1984, when "Kehai" founded the "Kehai Computer System Co," Group 506 was one of this company's development departments. The MCS Laboratory was jointly run by the Electrical Engineering Institute and "Kehai" so that their energy could be concentrated on the research in special development projects. The institute controls the laboratory personnel, while "Kehai" controls the working conditions, funds, popularization, commission sales, and financial matters.

The area of development for the MCS Laboratory is the use of mechanical equipment in combination with microelectronic technology and automation through program control. China's computer technicians are not yet ready to go deep into the field of mechanical and electrical production development, while the technicians of industrial and mining enterprises are mostly unfamiliar with computers. The MCS Laboratory therefore provides a bridge between these two types and has ample opportunity to demonstrate its expertise in the field of mechanical and electrical equipment and to trial manufacture these products of the 1980's level. The funds required for scientific research in the laboratory come mainly from its research achievements and royalty from the transfer of technologies. The other sources are bank loans, direct sales of scientific research products to the users, and participation in competitions on the market, all through its own efforts. Because of the difficulty of producing heavy mechanical equipment, the laboratory cooperated with Nei Monggol's Second Machinery Manufacturing Plant in jointly establishing an industry control laboratory. Both parties invested in the venture and jointly designed this laboratory. The terms of cooperation provide for division of work in production, common efforts in marketing, and equal sharing of profits.

According to "Kehai's" new management system, the leadership of the MCS Laboratory has full authority over its manpower, funds, and materials. Therefore, the laboratory was able to expand rapidly with the number of its personnel increased from 6 to 16. The arrival of reinforcement has lowered the average age of personnel from 44 to 28, and a new development work force of different echelons and full of vitality is being initially formed.

9411
CSO: 4008/2090

SSTC OFFICIAL INTERVIEWED ON SPARK PLAN

Beijing RENMIN RIBAO in Chinese 15 Mar 87 p 3

[Interview with Xi Huida [1153 1920 6671], director of the "Spark Plan" Office of the SSTC, by Chen Zujia [7115 4371 3946]: "What Can Science and Technology Workers Do for 'Spark Plan'?; The Planned Introduction of Suitable Technologies to Rural Areas"; Beijing, date of interview not given; first paragraph is source-supplied introduction]

[Text] The "spark plan" being implemented on a national scale has attracted the attention of many readers. They have written to inquire about the problems encountered in this plan. Therefore, our correspondent paid a visit to Xi Huida, director of the "Spark Plan" Office of the SSTC.

Question: The purpose of the "Spark Plan" is to introduce science and technology to the rural areas. What are the technologies to be introduced under this plan?

Answer: Generally, we stress the adoption of suitable advanced technologies; that is, the advanced and most practical technologies, including agricultural, industrial, and other technologies which the rural areas have never had. However, the science and technology to be developed, demonstrated, and propagated under the "Spark Plan" are of different levels. The projects of the state, the provinces, and the counties are not the same. There should be technical echelons, because some technology not considered advanced in certain provinces, may be of pioneering and demonstrational significance in other areas.

Some people interpret "suitable advanced technology" as "indigenous technology," and believed that the "Spark Plan" is concerned with what is "small, indigenous, and run by the masses." This is a mistake. Generally, the technologies propagated by the "Spark Plan" should produce economic, environmental, and social benefits. Only those technologies which can produce optimal economic benefits and protect the environment and the resources can be called "suitable advanced technologies" to be propagated by the "Spark Plan."

Question: Are you referring to the shift of the world's popular technologies?

Answer: Yes. On the whole, we should shift advanced technologies from foreign countries to China, from the eastern to the western region, and from the cities to the countryside; and apply the results of experiments in production. This trend cannot be reversed. In a certain sense, the purpose of the "Spark Plan" is to promote these shifts. However, the shift of technology must not be interpreted as laying down some burden. In some localities, some technology devoid of vitality and causing uncontrollable pollution was shifted to the countryside. This is irresponsible action.

Question: Can you tell me some specific features of the "Spark Plan"?

Answer: As usually said before, "Spark Plan" projects are "short, level, and speedy" projects, calling for speedy returns. Therefore, the SSTC is mainly concerned with the overall planning, and leaves the planning for different trades and regions and for specific projects to the local science and technology commissions. There are certain changes each year, and that is why it is very hard to be specific about the details.

The "Spark Plan" has three main goals during the Seventh 5-Year Plan: to develop 100 complete sets of technical equipment that are suitable for the rural enterprises and to organize large-scale production; to establish 500 exemplary technical enterprises to provide the rural enterprises with complete sets of techniques and technologies, rules of management, product designs, and methods of quality control; and to train 1 million intellectual youths and basic-level cadres in the countryside so that they can master one or two advanced technologies that are suitable to their own localities.

Question: The comrades in some localities want to start a "Spark Plan" project because of their local resources. What are your views on this?

Answer: It is very important that they should study their local resources and proceed from their superiority of resources. However, they cannot start a project simply because they have the natural resources. They must consider the question of funds, labor quality, transportation facility, and other conditions comprehensively. More important still, they must know whether the commodities produced can be competitive on the market. They must be soberly aware of, or able to predict the capacity of the market and how much can they share it. They must have a foothold on the market before they can derive any benefit.

Question: The "Spark Plan" has been going on for 1 year. How are its results?

Answer: On the whole, the results are not bad. The completion of state projects alone in 1986 has increased the output value by 150 million yuan and the taxes and profits by 30 million yuan. Generally speaking, the projects planned at the prefectural and county levels produced even quicker and better results. Tne results were good because feasibility studies were conducted and, more important still, careful investigations and study were carried out before the projects were decided on. These projects had the strong support of

the S&T units. Furthermore, the system of matching investment was practiced, and most of the funds were raised by the localities themselves or through bank loans. That was why they were highly regarded by the leadership at various levels.

Question: Can you tell me how the implementation of the "Spark Plan" was organized?

Answer: The outline of implementation was worked out as a guideline by the SSTC and the ministries and commissions of the central government concerned after consultations with the localities. The provinces, municipalities, and the departments of the central government concerned worked out their project plans on the basis of this outline. After getting the SSTC's concurrence, they separately organized the appraisals and then the implementation of their plans. The SSTC's share of work is to conduct investigations and study, to coordinate the plans and exchange of information, to check the work, to implement the policies, and to distribute the state allocations and loans. The routine work was undertaken by the "Spark Plan" staff office. As I understand, most provinces, municipalities, and prefectures have set up their comprehensive leading body with the science and technology commission taking charge of the routine work.

Question: As we understand, many readers, including not only natural science workers, but also social science workers and some professional artists, hope to make their contributions to the "Spark Plan."

Answer: This is very good. We warmly welcome them. Since the "Spark Plan" is a plan for science and technology, there is comparatively more opportunity for the natural science workers. Social science workers also can do something, such as offering library services, conducting surveys on market demand, working out comprehensive regional plans, and forming integrations of regions and trades. In all these tasks, we need the combined efforts of natural science and social science workers. As for artists, they may probably cooperate with the ceramics and textile trades which also need their skill. On the whole, we warmly welcome more experts and scholars coming to join those who are bringing science and technology to the countryside.

9411
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VIEWS OF YOUNG, MIDDLE-AGED SCIENTISTS REPORTED

Beijing GUANGMING RIBAO in Chinese 7 Nov 86 p 1

[Text] What are young and middle-aged scientists and technicians thinking about? What are their views, work, and living conditions like? Not long ago, the Hunan Science and Technology Association conducted a questionnaire survey of 1,679 young and middle-aged scientists and technicians.

Young and middle-aged scientists and technicians want to make more contributions to the Four Modernizations. Scientists and technicians with middle and high technological positions made up one-half of those surveyed. In addition to completing their professional work, they still have latent strength which they want to use to make more contributions to the Four Modernizations. The survey showed that 409 individuals want to participate in strategic planning deliberations; 559 individuals want to participate in concrete program demonstrations, and 648 individuals want to participate in information services.

Young and middle-aged scientists and technicians eagerly desire to renew their knowledge. Sixty-two percent of the subjects of this survey graduated from school before 1965. One of the questions asked in the survey was, What do you most need scientific and scholarly associations to do for you? 1,257 individuals suggested, "Understand the directions of domestic and international science." 1,134 individual recommended, "Study new technical knowledge." 713 individuals recommended, "Study specialized theory." And 629 recommended, "Conduct research discussion on special subjects." There were 684 individuals who thought that their inability to renew their knowledge in a timely fashion negatively affect their ability to maximize their potential in their professional positions.

The social standing of scientists and technicians has clearly improved. In response to the survey's question, "What has provided you with the most satisfaction since the holding of the National Science Convention?," 1,361 individual responded, "Intellectuals have received the respect of society"; 559 responded, "Science and technology cadres have been heavily relied on," and 740 individuals responded, "Problems left from history have been resolved."

What kind of spirit should scientists and technicians advocate? What style of work should they cultivate? 1,163 individuals approved the "Dedication, creativity, truth-seeking, and cooperation" of the Chinese Scientific Association's "Three Bigs." What problems relating to spiritual culture development are worthy of the attention of young and middle-aged scientists and technicians? 1,049 individuals responded, "Jealousy of capable persons"; 715 individuals responded, "Money-chasing"; 395 individuals responded, "Unwillingness to work together with others"; and 366 individuals responded, "Nonobservance of scientific morality."

As for problems affecting the development of abilities of young and middle-aged scientists and technicians, 695 of those surveyed responded that the main source of current negative effects on the full development of the abilities of young and middle-aged scientists and technicians was "Not enough autonomy"; 573 responded that it was "bureaucratism in leadership, preventing knowledgeable assignments of individuals according to their abilities"; and others responded that it was "Substandard quality of logistics services," "Heavy burdens of family responsibilities," and so on.

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CSO: 4008/2036

STRIDES IN ADVANCED DEFENSE SCIENCE RESEARCH NOTED

OW220400 Beijing XINHUA Domestic Service in Chinese 1200 GMT 21 May 87

[Article by correspondents Yu Qingtian and Su Kuoshan]

[Text] Beijing, 21 May (XINHUA)--A work conference on advanced research in defense science and technology that just ended has heralded in a new field for building up the capability for developing weapons and equipment. China has conducted systematic work and achieved rapid and fruitful progress in advanced research on defense science and technology.

As the basis and premise for developing weapons and equipment, advanced research on defense science and technology aims to continuously explore new theories, techniques, materials, and technologies for laying the technical foundations and building up the capability for studying, manufacturing, and upgrading weapons and equipment. The research generally includes applied basic research, applied research, and development of advanced technology.

Initiated in 1985, the research has yielded top-of-the-line achievements, some of which have been successfully applied to the manufacture of prototypes during the past 2 years. Practice shows that advanced research is the key in keeping up with technological progress as well as an important measure for attracting and training top-notch scientific and technical personnel. Accelerating advanced research can shorten the period and conserve expenditures for research projects, thereby enabling defense science research units to become producers rather than only consumers as quickly as possible.

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ROLE OF DEFENSE INDUSTRY COLLEGES IN ECONOMIC DEVELOPMENT

Beijing GUANGMING RIBAO in Chinese 3 Nov 86 p 2

[Article by Zhu Wenqin [2612 2429 3830]: "Defense Industrial Colleges Want to Serve Economic Development and National Defense; Beijing Engineering Institute President Zhu Hesun Airs Views; first paragraph is source-supplied introduction.]

[Text] Author's Note: Zhu Hesun [2612 7729 1327]: Chemical engineering specialist and professor. 1951 graduate of Dongwu University and 1953 advanced degree graduate of Zhejiang University. Appointed teacher at Beijing Engineering Institute in 1955. Became Vice Chairman of the Chemical Engineering Department of this institute in 1983. Acepted invitation to become President in 1984. Has been in the forefront of education and scientific research for nearly 30 years. Aside from educating undergraduates, has graduate students and doctoral degree students and has scientific research accomplishments in various chemical engineering fields, such as mass transfer processes, solid-state chemistry, and materials science. Has written nearly 40 scholarly papers, and received the nation's second-place prize for scientific and technical achievement in 1985. Currently conducting research relating to plasma chemistry and surface science.

In this new age of socialist modernization development, how should the defense industry colleges educate their students, and how should they develop? This reporter interviewed Beijing Engineering Institute President Zhu Hesun this autumn in October.

President Zhu said: "Defense industry colleges must implement the word 'shift' in the policy of 'guarantee fulfillment of military tasks while shifting to civilian production,' making the schools serve both the development of defense and the development of the people's economy--'Using two wings together to fly,' to use one of our figures of speech. To do this, it will be necessary to carry out reforms to augment their abilities to adapt and compete."

The Beijing Industrial College was the first college of science and engineering created by the Party. Established in 1940, its antecedent institution was the Yenan College of Natural Sciences. Its successive presidents have included proletarian revolutionaries such as Li Fuchun and Xu

Teli. In 1952, it was designated the Beijing Engineering Institute. This national key institution of higher learning has already produced more than 30,000 scientists and technicians and has made important contributions towards the development of our nation's space navigation activities and the development of atomic and nuclear energy.

Before the "Cultural Revolution," the Beijing Engineering Institute was a defense industry school that adopted extremely secretive measures--the school was not identified by any signs, and even the class notebooks of students were collected everyday and locked in special security boxes. All of the programs and departments established at the school were of a defense industry nature, and the adaptability of its graduates in civilian society was relatively limited.

"Becuase of this," President Zhu said: "In putting into practice 'guarantee fulfillment of military tasks while shifting to civilian production,' the difficulty of the 'shift' is relatively large. First, there is an obstacle in thinking, and second, there is a lack of experience. It is especially difficult for middle-aged and older teachers. It is essential that we have the boldness to put the past behind us. If the school is to continue to exist and develop, it must resolutely carry out the policy of 'transfer.'"

From 1980 on, this school has increasingly paid attention to "guarantee fulfillment of military tasks while shifting to civilian production" on its reform agenda, and after several years of effort there has been a fundamental change in the features of the school. This defense industry college has become a comprehensive institution of higher learning with a concentration on industry that has a total of 16 departments and programs integrating science, engineering, management, and the humanities, making admirable strides in the "Opening up of education." In the adjustment and transformation of the school's system of courses of study and programs, 23 of the original 33 defense products programs and defense industry service programs were converted into science education programs, and were tansformed into combined military and civilian programs. At the same time, 3 applied science and engineering programs were added, 9 new courses of study and interdisciplinary courses of study were established, and the usual conventions for courses of study and programs were broken with the creation of a research center for robotics and materials science. Four more research centers of this type will be created in the future. An Industrial Design Department established by the school last year is a new interdisciplinary program for training students in engineering and art. These revisions and transformations in the school's courses of study and programs have changed the defense industry programs into programs stressing general applications, in which defense industry and general applications are mutually integrated, and have changed the products programs into engineering techniques coruses of study and programs. The school holds 766 classes for 4,800 undergraduates, a nearly two fold increase since 1979. Among these classes, core courses, basic courses, and basic techniques courses make up more than 85 percent. For the 1,200 graduate students, 209 classes are held, and there are a total of 203 that have a research orientation. These penetrating changes have resulted in trained human resources with

extensive knowledge, firm foundations, and strong adaptability, enabling them to serve national defense modernization and the development of the people's economy.

President Zhu said that for many years, this school did not have any relationships with the outside world, as if it was an otherworldly haven situated in the suburbs of Beijing. In the transition from a closed institution to an open institution, the school initiated public education programs to strengthen its relationships with civilian society, opening a night school and a correspondence school, with 63 correspondence stations set up throughout the nation in 17 provinces, municipalities, and autonomous regions and 3 branch schools established in Beijing to train regional specialists and specialists for enterprises. Since the school's laboratories were opened up to the public several years ago, they have performed product tests, inspections, and processing tasks for more than 200 industrial enterprises. President Zhu happily told this reporter: "We feel that the open education approach will continue to expand. As the quality of education improves, the achievements of scientific research will play an important role in the development of the Four Modernizations. During the past few years, our school has received 17 National Invention Awards and National Science and Technology Advancement Awards, 33 State Scientific Commission Awards, and 111 National Major Technolgoical Transformation Awards. In a word, my view is that if defense industrial colleges are to develop, they must pursue education for the Four Modernizations and integrate defense and civilian educations, to augment their adaptability."

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SCIENTIFIC RESEARCH APPLIED TO ECONOMIC DEVELOPMENT

Beijing GUANGMING RIBAO in Chinese 20 Nov 86 p 2

[Article by Zhu Wenqin [2612 2429 3830]: "How to Better Apply Scientific Research of Institutions of Higher Learning to Economic Development; Responsible Persons of the Science and Technology Section of the National Education Committee Make Four Suggestions]

[Text] How can the scientific research work of institutions of higher learning better serve economic development? Recently, responsible comrades of the Science and Technology Section of the National Education Committee pointed out to a research and discussion group of administrative cadres of national institutions of higher learning that it ought to be actively applied towards economic development in accordance with our nation's circumstances and the schools' characteristics. Their principal suggestions were:

1. In accord with the needs for training human resources and developing national science and technology, basic research and applied research should be conducted in accordance with a set ratio, emphasis should be placed on the development of basic research with prospective applications and applied research that has a comparatively large impact on the people's economy, and there should not be excessive development of pure basic research. Applied research subjects also should be carefully selected. Current expenditures for basic research in our nation's institutions of higher learning make up only 13 percent of all expenditures, far below the percentages expended in other nations. Decreasing this percentage further would not be appropriate; it should be correspondingly increased as the people's economy develops. Expenditures for applied research make up 59.3 percent of all expenditures. This emphasis should be continued in the future.

2. Take appropriate measures to augment the development of technolgoy, paying special attention to the development of advanced technologies that are key to the development of the people's economy and have a potential for successful competition in international markets; to the development of institutions of higher learning where science studies are relatiely comprehensive, prominent scientists are relatively concentrated, and scientific thought is comparatively lively and advanced, to enable students to come into early contact with current scientific findings and new technologies; and to closely

At the same time, a certain amount of attention should be paid to the development of applied technology and the support of industry and agriculture, and especially to village enterprises.

3. Choose effective measures to accelerate the transfer of scientific research achievements to production to more quickly produce economic benefits. To do this, it is necessary to augment information exchange, to take steps to link up different channels of communication, to promote the commercialization of scientific and technological achievements, to actively expand technical markets, to create technical intermediary and service organizations, and to institute comprehensive planning and management for relevant units.

4. Strengthen cooperation between producing organizations and schools, develop horizontal relationships, establish integrated structures, develop organizations for cooperative research, enable scientists and technicians to hold joint appointments, and develop a variety of exchanges. As for the problems that are encountered in horizontal relationships and the contradictions that come into existence, it is necessary to promote solutions on the basis of mutual understanding and trust. They may sign contracts or agreements in advance of their actions to confirm their intentions, or work out arrangements that are in conformance with existing government policies, and some problems may need impartial arbitration organizations to undertake to mediate or decide them.

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IMPORTANCE OF ZHONGGUANCUN IN TECHNICAL DEVELOPMENT

Beijing LIAOWANG [OUTLOOK] in Chinese No 7, 16 Feb 87 pp 9-12, 17

[Article by Gu Mainan [7357 6701 0589], Zhu Jigong [2612 4949 0501] and Meng Xiangjie [1322 4382 2638]: "After Leaving Research Institute; Seen and Heard on Zhongguancun's Electronic Street"]

[Text] When they come to Zhongguancun in Beijing's northern suburbs, people will notice that this tranquil boulevard of a few years ago is now lined with shops with shop signs of various companies.

"Zhongguancun is a place where scientific research agencies are concentrated so what does this variety of companies have to do with research institutes?" reporters asked Secretary Hu Qiheng [5170 0796 1854] and Deputy Secretary Hou Ziqiang [0186 5261 1730] not long ago when they were visiting the Chinese Academy of Sciences.

"The appearance of these companies--also called 'Zhongguancun Electronics Street' wasn't accidental. The general background is that in the past few years the entire academy has been considering how research can be shifted towards production and applications to serve the national economy. Scientists have only to leave their ivory towers and use advances in science and technology to promote industrial modernization to enable us to compete with the other countries. Some of the scientists and technicians of the research institutes in Zhongguancun are recognizing that they themselves shoulder this historical mission and have left their ivory towers. In recent years, some institutes and factory and mining enterprises have jointly started joint research and production companies; some have started companies to produce and market high tech products; and some scientific researchers have taken concurrent jobs in production departments. In sum, the institutes are changing, just like silkworms changing into cocoons..." Hu Qiheng made a gesture to suggest silkworms changing into cocoons and laughed. Hu Qiheng is an automation specialist trained in New China. She is concurrently director of the Institute of Automation. The China Automation Technology Company which was created with funds primarily from the institute, is under her active leadership.

"But why is a research institute running a company?"

They said that in terms of the system, much of the business of units subordinate to the research institute is restrained by various aspects. They lack autonomy and do not adapt to production of goods. Hou Ziqiang is a 49 year-old acoustics technician. Not long ago he inspected some high tech companies in Silicon Valley and in the Boston area, and from the perspective of the international environment, he talks about the necessity of starting high tech industries.

"The vitality which the small companies in Silicon Valley exhibited in promoting technological advances appeared to make people feel uneasy. Now, it is not just China, the Soviet Union, the United States, and England who are reforming their technological systems. This is because the cycle of new inventions and new technologies has accelerated greatly. For example, in the last 10 or 20 years, the appearance of microelectronic technology has lead to the appearance of a series of domestic electrical appliances. The appearance of high technology shows that the impact of science and technology on the economy is extraordinary and if the results of scientific research cannot be promptly converted into products a country's economy cannot advance. High technology isn't ordinary technology. It is knowledge intensive and technology intensive and converting it into products requires a certain knowledge and technology, that is, it is most appropriate for the inventor himself or someone who has similar knowledge to convert it into a product, but this introduces changes conceptually. For example, in England, university professors initially disdained such work. Subsequently, they discovered that the results of their own research were converted into products by Americans and sold back to England, thus the professors of Cambridge University started a scientific industrial park and converted research results into products which competed internationally. According to estimates, by the year 2000, high tech products will make up approximately 50 percent of the volume in the world market. This means that countries must consider changing the make-up of export goods. If they export low grade goods, and do not develop high tech goods, the economy of the country will be left behind. China's research agencies have long relied on state support, research projects have been carried out accordingto the direcgove type plans, the overwhelming majority of scientific and technological personnel are concentrated in 1,005 research institutes, thus the results they make cannot be converted into products. Several years ago, some scientists and technologists had great enthusiasm for contributions to modernization, smashed official concepts and took the first step to create some high tech companies with the aim of converting the results of the institutes into high tech products and first entered the domestic market and when there were conditions, entered the international market.

At the suggestion of officials of the Academy of Sciences, we came to Zhongguancun's Electronics Street and visited eight or nine companies and what we saw and heard was fresh and new.

Science Researchers Running Companies Do Not Abandon Research for Business

One day we visited a sensor technology company. This company was set up in a building in front of the Institute of Dynamics building. When talking about how the company got started, deputy researcher and manager Fan Liangzao [5400 5328 5679] said: "I worked in the Institute of Dynamics for 30 years, wrote many papers, won two science and technology prizes, but these results were just like fighting only on paper, often the day the results appeared in the paper was the time that they were left out in the cold. I thought: if the results we work so hard to produce cannot be converted into productive forces, why bother with research? One year at a meeting I learned that the pressure sensor which was used by powder magazines and security protection departments was imported and cost $600. And it occurred to me that we could make this sensor ourselves. This idea won the support of the academy leadership and they appropriated 100,000 yuan in expenses and in 1984 we started the sensor technology company in a wooden building. Now we have 800,000 yuan in assets, the value of annual production is several hundred thousand yuan and the products we produce include a transistor pressure sensor, optical sensor, sonar sensor and strain-type pressure sensor. This year's estimate of the value of production may reach 1 million renminbi and $800,000. By 1990 the value of production per capita may reach $100,000."

Then Fan Liangzao took us on a visit to the laboratories and product testing shops in the Haidian District. He said: "The company now has three high level researchers, four middle level researchers, three technicians, three technical workers, five contract workers, and one manager. Apart from a plant manager in Haidian District, the rest all come here from various institutes of the Academy of Sciences to work. Although we still draw our salary from our original units, the company returns the money it earns to the original unit and it is given as bonuses according to each person's contribution."

When talking about the company, he said: "We decided to start the company because we wanted to travel a road we had brought into the world, not to abandon research for commerce, but to convert the results of our research directly into wealth. In the past in the institute we looked upstairs to do research and stretched out our hand to the state for money, but when the thing was produced, that was it. Now we can turn our results into products, but just making them won't do, we also have to find a way to sell them. The only capital we can borrow is the results of our hands and heads and the technology they represent and each penny comes hard."

The Substance of Technological Development, Production, Promoting Applications, Technological Service

In an office in the Institute of Automation we met Zhang Jialin [1729 1367 2651], a high level engineer and the general manager of the China Automation Technology Company operated by this institute. This middle-aged scientist and technician said: The Institute of Automation is a comprehensive new technology institute focused primarily on automated

control and information processing technology. In the past when a result was evaluated that was it, the so-called gift--exhibit--sample--scrap. Three years ago, to change this situation, the institute started a company with the technological forces of the entire institute as backup to concentrate technological development, production, promoting applications and service as one entity and implement limited combination of technology and trade. The company implements separation of government and enterprise, independent accounting and responsibility for profit and loss.

Zhang Jialin introduced us to the high tech products developed by this overlapping company: a high resolution color graphics system, a petroleum well-measuring explanation system, fully automated integrated circuit lead linker, etc. As he told us about this company's products he said that through running the company they could better run the institute according to economic laws. Some of the management work has gradually become more socialized. For example, in the past when some material supply was eating from one big pot economic benefits were not considered, as a result there was a large stock of goods, creating a great deal of waste. Now the materials and conditions needed for developing high tech products can be resolved by trading on social forces, and both save money and save time. In less than 2 years the institute has provided 20 kinds of high tech products to society through the Chinese Automation Company, something which was unimaginable in the past.

"The company has not been in business long, but it has displayed a great deal of vitality so that over half of the scientists and technicians in the institute have begun to work for the company, the company has provided the necessary market feedback to the institute, the institute transmits the tasks directly to the topic groups, and now a total of 10 topic groups have accepted the tasks of developing high tech products. After the products are developed, the company will set up production, and the scientists and technicians of whichever topic group develops a product with high benefits, will be better rewarded. The topic group should take responsibility for the product throughout and at any time resolve problems presented by the customer. Due to the close combination of the results of the labor of the scientists and technicians and the results and rewards, the scientists and technicians are concerned about use by the customer and frequently take the initiative to find customer problems which need to be resolved."

In the Institute of Acoustics building we saw Keli High Tech Company president, Tu Yan [1458 3543] and first vice president, Li Yunyan [2621 0061 6056]. These two middle-aged scientists used to be officials of two laboratories of the Acoustics Institute. After introductions, we pointed to a photograph on the wall of Premier Zhao Ziyang and State Council Member Comrade Song Jian during a visit to an exhibit of this company's products and asked "We've heard that Comrade Song Jian captioned this picture for you 'A Bridge of Science to the People', what does this mean?" Yu Yan and Li Yunyan immediately began to talk. They said that the rise of the high tech tide internationally in recent years has created a feeling or urgency in everyone. Abroad, the growth of high technology

is extremely fast and the rate of product updating is also accelerating greatly. The boundary between basic research and applied research is becoming increasingly vague, all research must be linked with products. In the past research was conducted in the laboratory with the door closed, once results were produced and awarded prizes that was it; when money from the state ended, the task was finished. Scientific research and production were disjointed and you couldn't see what role your labor had in promoting the national economy. Thus, we suggested: "We can't always eat 'imperial food'! Can we convert the results of our research into products through a company?" This idea was supported actively by the academy leadership and in the winter of 1984 the forces of our two laboratories pulled together to create the Keli Company, and after over 2 years of hard work we have developed into a joint research and production company of preliminary scale.

The two presidents took us to visit their digital systems development department, microcomputer applications department, office automation department, intelligent instruments department, software network development department, and physical measurement development department and asked the scientists and technicians who were working to debug and demonstrate various image processing instruments: there were laser character image processing, high speed signal processing and office automation and plant data acquisition and processing systems, etc.

"We are following trends internationally. Not only are these domestically assembled high tech products replacing imported goods, thus saving the country a great deal of foreign exchange, but we are also constantly surveying users' trial use situations and we are awarding all units which are using the products well a bonus. For example, after the Anshan City Post and Telegraph Bureau had been using a data acquisitions system supplied by our company in the mail sorting process, the work which had been done by 18 persons in 2,690 hours was reduced to a task requiring six persons 100 hours; or the Handan Seismic Station which successfully predicted an earthquake on the basis of an abnormal electromagnetic wave signals displayed by an instrument we had supplied and later wrote a special letter of thanks to us." When Li Yunyan finished speaking, we said: "This is probably a wonder produced after the bridge was built!" Those at the meeting began to laugh.

The two presidents said that the Keli Company implements business style management, personnel are hired by advertising, and first rate talent is publicly recruited from relevant institutes of the Academy of Sciences and society, each worker is paid on the basis of how much benefit he creates, last year the value of production reached 35 million yuan, 3.8 million yuan was handed over to upper echelons in taxes and profits, the company has a total of 90 specialized staff of whom 10 percent are engaged in high tech research, while 41 percent are above elementary level, in future they are prepared for steady progress and will strive to get high tech products into the international market as soon as possible.

The Era of Chinese Exported Technology Has Begun

"Polypropylene Chemical Fiber Plants through China do not have to report to the Ministry of Textiles before starting work, but they certainly will report to us and ask me: 'Do you have any temperature lowering (mili)?'" Fu Xueqin [0265 1331 0615], president of the Chemistry Institute's new technology development company said proudly picking up a glass bottle of white granules. Not long ago temperature lowering (muli) won the Vice Prime Minister Maystadt award at the 35th Brussels (youlika) World Inventions Exhibition not only because it was an invention, but also because it had successfully been turned into a product.

After this white-haired middle-aged man had graduated from Beijing University he worked for over 20 years in the Chemistry Institute. He said that temperature-lowering (muli) was developed by the famous chemist Qian Renyuan [6929 0086 0337] and others and in 1980 won second national invention prize. It is an additive material in polypropylene spinning and plastics production. Mixing it in polypropylene and plastic can lower processing temperature, save on energy and improve product quality and lower production costs. In the past, because no one was concerned about the problem of the "intermediate zone," generally when a laboratory successfully developed something they were finished and could not spur on the development of production technology. Now we have built an intermediate test base for producing temperature lowering (muli) at Changping, four production lines produce 520 tons of temperature-lowering (muli) annually, a fourfold increase over the previous year, and can satisfy the needs of over 60 domestic polypropylene chemical fiber plants. According to statistics, it has already created economic benefits of 90 million yuan due to the widespread use of temperature lowering (muli) by chemical fiber industry nationwide.

After we had talked for a while, Ma Furong [7456 4395 2837], deputy director of the Institute entered. This female director and President Fu said enthusiastically that in Southeast Asia there are no polypropylene plants but that they have reached an agreement with Thailand for China to supply Thailand with technology and equipment in a Thai-built polypropylene plant.

When we arrived at the Sanhuan New Materials Research Development Company, President Wang Zhenxi [3769 7201 6007] introduced us to the company. Their company was organized in May 1985 by some of the mainstay scientific researchers of the Institute of Physics, Institute of Electronics, Institute of Electrical Engineering, and the Changchun Institute of Applied Chemistry. Not long ago they took aim at superstrong magnetic materials which have international competitive ability as a project for research and development.

Wang Zhenxi showed us neodymium-iron-boron permanent magnetic alloy packed in two small delicate boxes. They were only the size of a fingernail but their attraction is extraordinarily strong andit takes a great deal of effort to separate them. Wang Zhenxi said that neodymium-iron-boron

is a third-generation rare earth permanent magnetic material, performance is outstanding, cost is modest, it can be used widely in such industrial sectors as electronic equipment, electro-acoustical components, instruments and meters, and automobiles, and new areas of application can also be found. For example, the oil well oil extraction pipes are constantly getting blocked requiring 3-5 days to clear, as a consequence the state loses 500-600 million yuan per year. Using a neodymium-iron-boron pressure reducer they can be used continuously for over 100 days without a blockage.

There are currently 10 laboratories in the world test manufacturing this material, but only a few countries, such as the United States, Japan and China can manufacture it. They have gone into production in cooperation with the Ningbo Magnetic Materials Plant. In September of 1986 neodymium-iron-boron permanent magnetic alloy products entered the U.S. market.

The Seeds of High Tech Industry

"Many of the high tech development companies which appear on Electronic Street could be said to be the seeds and embryos of developing China's high tech industry and in the tide of transformation of the science and technology system, high tech industries are being produced from institutes and they are decomposing and a fission reaction is taking place," Zhou Chengkui [0719 2052 1145], official of the Policy Bureau of the Academy of Sciences said after carrying out an inspection of the companies. Some of the facts heard and seen at the New Technology Development Company of the Computation Institute and Microbiology Institute and the Communications Computer Technology Company indicate that the seeds of high tech are quietly being sowed and have displayed very strong vitality.

Liu Chuanzhi [2692 0278 1807], president of the Computation Institute's New Technology Development Company took us to the sales department to observe the associative type Chinese card in use. An operator in front of a microcomputer equipped with an associative Chinese card input the character "zhong" and automatically at the cursor location on the screen were displayed frequently used word groups starting with the character "zhong" such as "Chinese Academy of Sciences Compututational Technology Institute," "Communist Party of China," and "Chinese People's Liberation Army."

Liu Chuanzhi said that this was invented by the chief engineer Ni Guangnan [0242 0342 0589]. The advantage is that the Chinese characters can be input proficiently without the need for specialized training, thus it is also called "intelligent Chinese character input." After the associative-type Chinese card went on the market it won the first prize in the Beijing Area Chinese Character System Suitability Competition early last year and several months later won the Applications Support System Prize announced by the State Council's Electronics Promotion Leadership Group. In less than a year it has been sold to over 20 provinces and cities and such areas as Hong Kong and Singapore obtaining encouraging social and economic benefits.

The Haidian District New Technology Development Center of the Chinese Academy of Sciences is also one of the earliest enterprises to be born on Electronics Street. President Chen Qingzhen [7115 1987 2182] said by way of introduction that for the past 3 years they have promoted 114 science and technology results and their own organization has developed 98 scientific research items. In promoting the results, "Kehai" [Academy of Sciences' Haidian] admittedly has paid serious attention to its own economic benefits, but what is more important is that it has exploited the "seed" function, and paid serious attention to socio-economic benefits. For example, they have test manufactured a new highly effective antibiotic--(topumeisu)--which is two- to fourfold more effective than gentamicin, and is the most effective of the amino-group glycosidic antibiotics. Currently only the United States, England, Japan, the Soviet Union, and Hungary can produce it. We import (tuopu) injections at a cost of $4.80 each, requiring an annual expenditure of over $1 million. Because the price is so dear, it cannot be generally used. But the quality of the (tuopu) successfully tested in "Kehai" is up to the pharmaceutical standards of the United States and England and the unit cost is only .4 yuan. Chen Qingzhen said that if our goal was purely profits, we could get rich operating a factory, but we have not done that. We have turned this technology over to pharmaceutical plants in such places as Tianjin, Chongqing and Changsha, fully exploiting the existing equipment and capacity of these pharmaceutical plants so that they can play its proper role in ensuring the people's health and saving lives and healing the injured.

The Chinese Academy of Sciences has now established over 80 technological development companies and although some are operated by the Academy of Sciences, some are operated by institutes, and some are operated by other institutes in the area, the personnel and funding were raised outside of the state budget, they are independently managed and responsible for their own profit and loss. Some people have likened these high tech industries which "split off" from institutes as infants leaving the mother. How to deal with these new things which do not yet have any rules to follow thus when defects or problems appear it should not be surprising. In our survey we learned that these new enterprises have obtained the vigorous support of the Haidian District governmental leadership and relevant function departments, and the Haidian District Agricultural Bank in particular has not stinted to accept the risk and provided help economically and this is commendable. However, in the future appropriate policies should be formulated in the areas of product pricing and tax revenue based on the actual situation in orderto ensure the further development and expansion of these companies. Again, in the case of ownership, which form is best, how can the state effectively carry out direction of these new enterprises, and such problems all have become part of the agenda and a brand-new topic of research which face economists.

8226/9604
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STATISTICAL INDICATORS OF CHINA'S ACADEMIC ASSOCIATIONS

Beijing KEJI RIBAO in Chinese 7 Mar 87 p 1

[Article by Zheng Tianfen [6774 3944 5358]: "Statistical Indicators of Four-Level Science Associations, Academic Associations, and National Science and Technology Associations"]

[Text] As revealed by the Comprehensive Planning Bureau of the China Science and Technology Association, after more than 1 month of intensive work, the collection of more than 6,000 copies of investigative reports, 40,000 survey forms, and 60,000 numerical data showing the basic conditions of the science and technology association system--all supplied by 138 national academic associations, and the associations of 37 provinces, autonomous regions, municipalities and cities directly under the central government--have been basically completed for the higher authorities.

The statistics at the end of 1986 was as follows:

The China Science and Technology Association consists of 2,814 4-level associations at and above the county level. Of the 2,741 administrative districts and counties, 87 percent have formed science and technology associations. There are 39,150 academic associations affiliated to the four-level science and technology associations (meaning associations and research associations throughout this article) with 5.99 million members and 2.7 million scientists and engineers; 3,433 academic associations at and above the provincial level with 2.84 million members; and 35,717 academic association at and below the prefecture level with 3.15 million members. A total of 138 national academic associations have joined 261 international academic organizations, and 397 persons are taking up posts in foreign academic organizations. There are 2,116 members of foreign nationalities.

In academic exchange, the academic associations at or above the provincial level held 36,000 seminars attended by 2,732,000 persons in 1986. A total of 371,000 theses were exchanged during these meetings. The national academic associations held 2,333 seminars with 244,000 persons attending and 117,000 theses exchanged. The national and provincial academic associations held 2,172 international academic meetings in China, attended by 133,000 Chinese professionals who submitted 15,000 theses; and by 14,181 foreign professionals who submitted 6,492 theses. The China Science and Technology Association

system distributed 1,331 types of academic journals to the public and published 95,000 theses in 1986.

The China Science and Technology Association system's factory and mine associations and its science popularization contingent have continued to develop. By the end of 1986, there were 4,052 basic-level factory and mine associations with 718,000 members; 45,000 basic-level rural science popularization associations with 3,847,000 members; and 59,000 rural specialized technical research associations with 1,444,000 members.

The scientific and technical consultation services offered by the China Science and Technology Association showed remarkable results in 1986. The associations at and above the provincial level and their affiliated academic associations organized 516,000 persons to provide 53,000 scientific and technical consultations, 65 percent of the total consultations provided during the Sixth 5-Year Plan. The contracts involved amounted to 630 million yuan in value.

9411
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S&T ENTERPRISE LEADERS QUOTED

Beijing LIAOWANG [OUTLOOK] in Chinese No 7, 16 Feb 87 p 17

[Text] "Without the participation of technological personnel, high tech development cannot expand much. We should fully utilize the specialized dominance of our academy to engage in products which have a Chinese character and competitive ability to enter the international market. This is the direction of our efforts." Fu Xueqing [0265 1331 0615], president of the Chinese Academy of Sciences' New Technology Development Company.

"New technology development and promotion work can be compared to spreading fertilizer and cultivating. Before, institutes produced many research results, including some of very high levels, but many people dearly wanted to create a "major variety" and were not willing to spread fertilizer and cultivate, thus there were no markets, no customers, nor any economic benefits. In future we should spread our wings and use high tech knowledge and high tech talent to promote high tech products." Liu Chuanzhi [2692 0278 1807], president of the Computation Institute's New Technology Development Company.

"If we only operated one company, we cannot explain the problems. Now from the perspective of this street in Haidian District, many companies like "Kehai" [4430 3189] are operated well and this proves that this path was correct." Jin Yanjing [6855 3601 7234], president of the Beijing Communications Computer Technology Company.

"Before there was a way of depicting science and technology support: 'helping one on a horse to see off on a journey.' Actually, some were helped on the horse but not seen off; some were given a horse and that was the end of it, thus many scientific research results came to a premature end. Facts prove that if there are no intermediate development agencies, it is very difficult to get scientific research results applied in production. The past few years we have adopted such forms as transfer of results to create 400 million yuan in economic benefits for society. The current situation is no longer 'finding something to eat,' and there is no shortage of development topics." Mao Guizhen [3029 2710 7201], president of Microbiology Institute's Technology Development Company.

"Some people think it is a "sacrifice" for scientists to engage in high tech development, but I think this cannot be called sacrifice. Organizations and leaders engaged in this work should have the qualities of scientists, entrepreneurs, and social activists. I now still have graduate students and the company has also established a research center so not only have we not abandoned research work, but we have linked research work and production even closer." Tu Yan [1458 3543], president of Keli High Tech Company.

"In the past we likened defining a research topic, completing a research topic and looking for a name after writing the paper as 'pointing to a rabbit, shooting the rabbit, beating the rabbit and scrambling for the rabbit.' Now we have changed this to 'pointing to the rabbit, shooting the rabbit, processing the rabbit and selling the rabbit,' that is spreading the research results of institutes through our processing and 'ripening' to enterprises so that scientific research personnel truly understand what are social benefits and how to serve the national economy." Chen Qingzhen [7115 1987 2182], Chinese Academy of Sciences Haidian District New Technology Development Center.

"I worked in the Institute of Physics for 23 years and 1986, when I started this company, was the most tiring year and the most significant year.

"The state has spent a great deal of money training us but in the past the only standard for weighing the level of scientific research personnel was whether or not a paper could be written, and when the paper was published it was considered crowned with success while in fact I felt it didn't mean very much. Now it depends on whether or not the research results can promote the four modernizations and whether or not it can enter the international market. The levels and talent can be produced only by really working in earnest and in fierce competition." Wang Zhenxi [3769 7201 6007], president of the Sanhuan New Materials Research Development Company.

"An undertaking ultimately succeeds or fails depending on policy, talent, and alliance. If we can guarantee talent flow and use policy to attract the top graduate students and university graduates to work in companies and be refined, and use the most hands-off methods and push everyone onto the international stage to compete, our undertaking may subsequently come out on top and our undertaking will certainly be a success." Fan Liangzao [5400 5328 5679], president of the Chinese Academy of Sciences Sensor Technology Company.

8226/9604
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FANG YI HOLDS SYMPOSIUM ON CIVILIAN S&T ORGANS

Beijing KEJI RIBAO in Chinese 13 Mar 87 p 1

[Article by Zheng Haining [6744 3189 1337]: "An Unusual Symposium--Fang Yi [2455 3015] Discussed With 'Jinghai' Leaders Important Plans to Develop Civilian S&T Organs"]

[Text] In the morning of 11 March, an unusual symposium took place in an office building in Zhongnanhai. The host was Fang Yi, CPC Politburo member and State Councillor; and the guests were Wang Hongde [3769 3163 1795], general manager of "Jinghai Computer Technology Development Co of Beijing Municipality," and Ji Cenghua [4764 1073 5478], science adviser of the company. Some responsible comrades of the State Science and Technology Commission [SSTC], the Chinese Academy of Sciences, and the Science and Technology Leading Group of the State Council were also present.

With a gentle smile, Fang Yi invited everyone to sit down, saying: "In today's symposium, my main purpose is to listen to your talk about the Jinghai Co. There is no question of leaders and followers, because everyone here is equal. Let every one talk about the ways and means to run civilian S&T organs well, to promote the rational flow of talents, and to serve the cause of science and technology well."

Wang Hongde said: "The comrade were elated to receive your invitation. It is a great encouragement to us."

The Jinghai Computer Technology Development Co of Beijing is a civilian, collectively owned enterprise engaged in scientific research, engineering, and a combination of technology and foreign trade under the system of independent accounting with sole responsibility for profits and losses. Its predecessor was the Jinghai Computer Machine Room Technology Development Co. In July 1983, the former computer engineers of the Chinese Academy of Sciences, headed by eight computer machine room experts and guided by the party's policies of economic structural reform and S&T structural reform, founded China's first machine room technology, relying on its own technology and the support of the leadership concerned in Haiding District. In more than 3 years after its inception, its technical business revenues reached 160 million yuan and the taxes paid totaled 20 million yuan.

Fang Yi asked: "What is the ratio of the volume of your computer machine room's business to the total national volume?"

Wang Hongde replied: "There are more than 100 machine room companies in the country. Jinghai's business volume accounts for one-tenth of the national total. Right now, Jinghai's comrades are working in many places in the country. It has 19 branches, and this number may be increased to 20 by the end of this year." He added humorously: "Operating machine rooms is actually like 'filling gaps.' Several years ago, we saw a gap between the producers and users of computers, and this was the gap to be filled by machine rooms. A machine room expert has the duty to fill this gap for the state. Thus, I took the initiative of locating the Young Intellectual Society of the Computer Institute. I served as its adviser and utilize this 'hardly noticed' work force to undertake the design, construction, installation, trial operation, and readjustment of computer machine rooms... .

Fang Yi ask: "Is the quality the best?"

Wang Hongde replied: "In 1985, we had some problems with the quality. After some serious efforts by us for their solution, 46 of the 86 tasks won embroidered banners and commendations. Our stature grew a great deal, and people said that Jinghai undertook 'turnkey projects.'"

A so-called "turnkey project" means that as long as the customer tells us about his technical requirements, we will be able to complete the design, construction, installation, trial operation, and readjustment of the equipment for the whole machine room. The customer can simply open the door with the key and work under the the required technical conditions.

When Fang Yi ask about Jinghai's technical work force, Wang Hongde told him that there are 5 senior scientists, 22 engineers, and 80 science and technological personnel with university or specialized college education, or higher education background, in addition to 40 computer software personnel trained at the company's expense. Wang Hongde added: "Many S&T workers want to come to our company now." Fang Yi said: "They should be welcomed. A rational flow of S&T personnel would help them to be used to greater advantage and to make greater contributions to the state. This is in line with the Central Committee's policy on the flow of talents."

Wang Hongde said: "In administration, our company stresses strict enforcement and compliance with law and discipline. I frequently told the company personnel that although the state wants to open to the outside world and invigorate the domestic economy, we must carefully remember that nobody in the company is allowed to accept bribes; that everyone must abide by the law and discipline; and that the reformers' good images must be preserved. We also welcome the departments concerned to check up on our work." In 1985, some relevant department came to check "Jinghai's" accounts, and as a result, "Jinghai's" reputation rose even higher. In March 1986, Wang Hongde returned with a citation from the Beijing Municipal Government. The citation read: "Jinghai Computer Technology Development Co of Beijing showed a keen sense of responsibility during the general checkup by the Discipline

Inspection Commission and have given outstanding performances in taxation, financial matters, and pricing, for which, a citation is hereby given."

On hearing this, Fang Yi nodded with great satisfaction. He said: "Fine! Fine! This is fine! Let the company keep up its good work. As long as we are fair and honest, we don't have to worry about what other people may say."

Next, Wang Hongde recounted to Comrade Fang Yi how the company got started. He said: "At first, we had no funds to start the company. Yet, without any state investment or bank loan, our revenues from technical development and technical services gradually accumulated and increased. If the company wants to make any long-range plan, it must make great efforts to turn out new products and new technologies. Each year, we appropriate 30 percent of our profits for technology development. At the same time, we have to pay attention to accumulation. We distribute our income according to neither the upper nor the lower limit, but rather take the middle, or a slightly higher level according to the policy "to each according to his work."

After listening to the Jinghai Co's report, Fang Yi said, you are quite right in confining your activities within the country. Of course, besides keeping your eyes on the domestic market, you should also to get into the world market. There is no need for you to bring sophisticated goods into the world market as a rule. You can either take full advantage of our own superiority or cooperate with foreign countries in development. He added: Civilian S&T organs must continue to turn out new products and new technologies, or they cannot survive the keen competition. The company's good will and good reputation must be preserved, and the time element must be taken seriously.

When the symposium concluded, Comrade Fang Yi said with a laugh: Today's symposium is very successful. There is a long and bumpy road ahead for the civilian S&T organs, and you should continue to work hard. You also need the support of various quarters in the society. Comrade Fang Yi also commended the government of Haiding District, Beijing for its active support to the civilian S&T organs.

9411
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NDSTIC TO EVALUATE TECHNICAL PERSONNEL PERFORMANCE

Beijing KEJI RIBAO in Chinese 20 Mar 87 p 1

[Article by Xi Qixin [1153 0796 2450]: "NDSTIC Meeting To Evaluate First Group of High-Level Technicians Ends"]

[Text] The National Defense Science, Technology and Industry Commission [NDSTIC] meeting for the evaluation of professional and technical performances ended on 18 March with the resolution that the NDSTIC would strictly adhere to the set standards, grant no favor or preferential treatment, carefully consider the contributions regardless of the contributors' academic and experience backgrounds, and refuse to promote anyone who is not qualified. More than 1,000 persons of the first group were appointed after this evaluation, and 65 of them were promoted in exceptional cases for their outstanding performances and contributions, even though they lack the required academic background and the minimum years of work experience.

This evaluation meeting was the first of its kind after the reform of the job title system. To make this meeting a real success, the NDSTIC formed an evaluation committee consisting of leaders at the commission level, well-known scientists, and technological experts in many major systems. The results of evaluations, after a strict scrutiny, were finally decided by the evaluation committee through anonymous votes. Ding Henggao [0002 5899 7559], NDSTIC director and researcher spoke at the meeting. He said: The first group of more than 1,000 persons have been evaluated and appointed at this meeting. All of them are now backbone elements in special and technical posts, and serving as the vanguard of the special academic and technical force. Many comrades are not only highly competent in their professions with outstanding performances, but also serving as tutors of MA or PhD researchers. They are also highly respected by their peers because of their important scientific research achievements.

In the course of evaluation, NDSTIC correctly handled the relationship between academic and vocational backgrounds, on the one hand, and technical skill and work performance, on the other. It held that in undertaking high-level professional and technical duties, people must have the academic background and the minimum years of work experience as stipulated by the state. This is necessary and proper. However, academic background and work experience are not the only requirements. Those who are competent in work, possess technical skills, and can produce good results in actual work, should not be buried even though they do not have the required academic background and minimum number of years of work experience. As long as they can meet the requirements of the post, we should give them have the opportunity to show their talent.

9411
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NEW RARE EARTHS EXTRACTION THEORY, SEPARATION TECHNOLOGY

Beijing KEJI RIBAO in Chinese 27 Feb 87 p 1

[Article by Sun Shuxing [1327 2885 5281]: "China Makes Important Breakthrough in Theory of Extraction and Technology of Separation of Rare Earths"]

[Text] The theory of simultaneous extraction of rare earths, its application, the "tertiary extraction" technical theory and design for the extraction and separation of light rare earths, and the result of research in industrial practice have simultaneously passed the appraisal sponsored by the State Education Commission. According to experts, this event marks an important breakthrough in the theory of extraction and the technology of separation of rare earths in China.

Rare earth elements play an important role in industrial and agricultural production as well as national defense. China's rare earth reserves rank first in the world; those of Baotou alone are equal to the grand total of all Europe. Because of the similarity of atomic structures, however, rare earth elements are usually in a state of associated growth, and the process of separation and extraction is fairly difficult. The "secondary extraction" method generally used in the world for tandem extraction has many defects.

Prof Xu Guangxian [1776 0342 2009] of the chemistry department of Beijing University and some others accepted an assignment from the Ministry of Metallurgy and began to conduct research in the theory of tandem extraction of rare earths and its application 14 years ago. By 1986, Xu Guangxian and Li Biaoguo [2621 2871 0948], with doctoral candidate Yan Chunhua [0917 4783 5478] under their guidance, had published 16 theses, all up to advanced international standards. As a new application of the research achievements in rare earth production, the "tertiary extraction" process is simple and highly flexible. Compared with the "secondary extraction" method, it has the advantage of producing two more types of products in addition to markedly lower production cost.

Industrial experiments in the "tertiary extraction" method according to the theory and design for the extraction and separation of rare earths were jointly conducted by the chemistry department of Beijing University and Shanghai Yaolong Chemical Industry Plant from July to September 1985. Their application in more than 1 year has proved their maturity. With computer

simulation, these experiments for the first time showed a forward leap from the stage of theory and design to that of industrial application without the intervening primary and intermediate tests. It not only saves manpower and money, but also, more important still, reduces the period from trial manufacture to actual application. Through on-line retrieval of international documents, it was found that no similar work has been publicized in other countries for 20 years from 1967 to 1987.

The "tertiary extraction" technology for the extraction and separation of light rare earths is now being popularized in several major branches of rare earth production in the country.

9411
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NEI MONGGOL RARE EARTH PROCESSING CAPACITY ENHANCED

Beijing KEJI RIBAO in Chinese 12 Mar 87 p 2

[Article by Hu Zuo [5170 1563]: "Nei Monggol Autonomous Region Has Become China's Largest Rare Earth Production Base"]

[Text] In the past 3 years, Nei Monggol's rare earth production enterprises have completed six technological transformation projects, and their intensive processing capacity is now in a fledgling stage. In 1986, the autonomous region's industrial output value of rare earth reached 138 million yuan, and the foreign exchange earned through export totaled $10,390,000. Nei Monggol has now become China's largest rare earth production base.

Despite its rich rare earth reserves, Nei Monggol had hardly any capacity for intensive processing in the past few years. What it produced and sold were primary products of rare earth ores, and the development of its rare earth industry was slow. To turn the advantage of rich rare earth resources into industrial strength and to make a breakthrough in the development of rare earth industry, the leading rare earth production enterprises of Nei Monggol and the production workshop of Baotou Rare Earth Research Academy have since 1984 invested 12 million yuan in six technological transformation projects. Baotou Third Rare Earth Plant, Baotou Rare Earth Metallurgy Plant, and the production workshop of Baotou Rare Earth Research Academy have separately transformed their original rare earth separation production line, adopted the new P507 technique of advanced world standards for the extraction and separation of rare earths, and conducted intensive processing of chlorinated rare earths for the production of secondary products. As a result, these three units' capacity for processing chlorinated rare earths has reached 720 tons, and their capacity for processing oxidized rare earths, 280 tons. No 202 Plant of the Ministry of Nuclear Industry has also transformed its old isotope-separation workshop which is now able to process 120 tons of rare earth hydroxide.

The improvement of Nei Monggol's rare earth production enterprises through technological transformation has also improved the quality of rare earth products and increased their foreign exchange earning power. The exported rare earth products have been upgraded from primary to medium-grade products which now accounts for one-third of all the foreign exchange earned from rare earth exports. The six technological transformation projects will greatly increase the capacity to process rare earth concentrates. Nei Monggol produced 18,000 tons of concentrates of various grades last year, and may in the future increase its output of single-element rare earth oxide by 400 tons with an increase of 36 million yuan in industrial output value, and 8 million yuan in profits and taxes.

9411
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SPECIAL CHARACTERISTICS OF TECHNOLOGY MARKET DESCRIBED

Beijing KEJI RIBAO in Chinese 16 Mar 87 p 3

[Article by Zhou Zhenhua [0719 2182 5478]: "Certain Special Characteristics of Technology Markets"]

[Text] Along with the planned development of China's commodity economy, technology markets have appeared everywhere. They are a strong impetus to the developments in China's economic construction and S&T structural reform. However, the development of technology markets has not been smooth sailing. Here we have problems with their external environment, such as the inadequate effective demands on them (especially from the large and medium-size enterprises) as well as problems with their internal mechanism and people's understanding of technology markets. Therefore, it is necessary to analyze and study the special characteristics of technology markets and to improve their operational mechanism according to the special laws governing them.

Technology markets may be classified into primary technical commodity markets, supplementary technical commodity markets, and service technical commodity markets, according to the way they serve the economy. The transactions conducted in primary technical commodity markets involve those intermediate commodities which cannot be used directly in the process of production until they are further transformed, such as patented inventions and technology transfers. The technical commodities exchanged in supplementary technical markets are those which can be directly applied in the process of production, such as a complete set of special production technologies including design data and technical process explanations. In the service technical commodity markets, the commodities exchanged are applied technical services, such as technical appraisal, technical consultations, and other compensated services. These three technology markets have their own special characteristics as well as their common features. They are related to one another and are mutually complementary in supply and demand in order that the commodities can be used and popularized. Therefore, we can consider them as an integral whole when we analyze their special operational characteristics. Generally, technology markets have the following operational characteristics:

1. Because the order of supply and demand on technology markets can be arranged in two different ways, it would be hard to determine their supply and demand conditions. As we understand, there are two special phenomena in the

production of technical commodity: First, technical achievement is made before there is a demand for it in production so that some way has to be found for it to be used and popularized in production. Second, there is an objective demand for new technology in production before such a technology can be supplied. Thus, supply and demand can be arranged in two different orders on the technology market: First, the order in which the supplier of technical commodity has to look for potential consumers. Since the application of the technology should be economically worthwhile, and feasible in terms of resources and materials, it may take a fairly long time to look for potential consumers. Second, the order in which the consumers of technical commodities have to look for their potential producer. Because of the difficulty in tackling the key problems and the long duration of scientific research, the required technical commodity cannot be produced at once, and that is why it also takes a certain amount of time for the potential producer to be found. Since there is a fairly long interval between supply and demand according to either of these opposite orders, the phenomena of supply being excessive to and short of demand usually exist simultaneously. Hence the difficulty of determining the conditions of supply and demand on the technology market.

2. The unique characteristics of the supply of technical commodities has resulted in the supplier's monopoly as a common phenomenon on the technology markets. Since technical commodities have the characteristic of software which embodies knowledge, its production (creation or invention) cannot be as easy as their reproduction (copying or reproduction). To protect the interests of the technical commodity producer and to encourage their production, it is necessary to give him some legal monopoly rights for a certain period. On technology markets, unlike other markets, there is only one seller of one technical commodity, and competition against him does not exist. On the other hand, there can be more than one buyer of the same commodity, and consequently competition exists among the buyers. The existence of one seller and many buyers is a decisive factor of the seller's monopoly.

3. The uncertainty of technical commodities accounts for the random nature of the market transactions. From the standpoint of use value, even though technical commodities may be transferred with compensation, there are many reasons why they cannot be transformed into productive forces in actual consumption. According to statistics compiled by some foreigners, the proportion of basic research results being actually used is 5 to 10 percent, while that of exploitive research results being actually used is 80 to 90 percent. Let us look at the question of value. Since it is basically impossible to compare the amounts of labor spent on identical technical commodities, there can be no way to reduce their values to a common social value. It is precisely for this reason that we find it difficult to determine the prices of technical commodities which are fairly often set at random. This random nature has given both the sellers and the buyers quite a lot of market risk.

4. Since technical commodities are not lost to the owner in the process of exchange, transactions on the technology market mainly take the form of transfer of the right to use them. Technical commodities as a medium of knowledge are not lost at the time of sale; they only pass from one person to

another, and, generally, their first owner does not lose the knowledge. Because of this special characteristic, the owner of a technical commodity is generally unwilling to abandon his ownership in a one-time transaction. He can transfer at the same time the right to use the commodities to many persons requiring them. This is undoubtedly a special privilege, because the right to use other commodities can be transferred to only one party at one time.

Because of these special characteristics, in the course of developing and perfecting the technology markets, we must adopt due policies to support the production of technical commodities, to stimulate the demand, and at the same time to strengthen the work of S&T legislation in order to improve these commodities' economic results and social benefits.

9411
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SCIENTISTS DISCUSS SUPERCONDUCTIVITY BREAKTHROUGHS

Beijing KEJI RIBAO in Chinese 2 Mar 87 p 1

[Article by Ji Cenghua [4764 1073 5478], Du Mingming [2620 2494 2494], and Huang Yong [7806 0516]: "A Golden Key to Success--Scientists of Institute Physics, Chinese Academy of Sciences, Discuss Important Breakthrough in Superconductivity"]

[Text] On 20 February 1987, Chinese scientists for the first time discovered a superconductor which begins its transition at more than 100 K. On 24 February, the release of this important news to Chinese and foreign correspondents caused a sensation in physics circles.

How was this breakthrough accomplished? What was the golden key to success? With these questions in mind, we came to the Institute of Physics of the Chinese Academy of Sciences located in Zhongguancun of Beijing.

Painstaking Exploration, Brilliant Success

Guan Weiyan [4619 4850 3508], deputy chairman of academic committee of the Institute of Physics of the Chinese Academy of Sciences, hurriedly returned from a meeting of the Physics Academic Association for our interview. He joyfully told us the historical background and great significance of the research in superconductivity. He said:

In 1911, physicist (Ao ang ni lun si) of Holland for the first time discovered the superconductivity of mercury with the aid of liquid helium at 4.2 K. This discovery attracted the attention of scientists in many countries. In 1957, U.S. scientists advanced the BCS theory. For the first time, they succeeded in giving a microscopic exposition of the state of superconductivity and produced a formula based on it. However, their theory could not help in the search for superconductive materials. People continued to update the materials and to look for superconductors with higher transition temperatures. It was not until 1973 that trigermanian niobium [ni san zhe 6281 0005 7926] with a transition temperature of 23.2 K was discovered.

While the research is going on, people have actively put superconductivity to practical use. Brookhaven National Laboratory of the United States produced superconducting power cables, while England manufactured superconductor motors to be used in warships and suspended trains. In the medical field, the use of

superconductors in nuclear magnetic resonance can very accurately diagnose cancer at its early stage. However, because of the high cost of liquid helium, the research results cannot be widely used. How people wish to have superconductors with an even higher transition temperature! If people can discover a superconductor with transition at ordinary temperatures, it will bring about phenomenal changes in the world in the same way the discovery of electricity did in the past. Today, we have finally discovered superconducting materials with a transition temperature above 100 K. This brilliant success represents an important forward step in superconductivity research.

"Group Championship" Wanted

Chief of the Institute of Physics Yang Guozhen [2799 0948 2823], one of the researchers, entered his office and spoke to us before taking his seat, knowing that we had waited there for some time. He said:

The achievements of research in superconductivity should be regarded as the crystallization of the collective efforts and wisdom of the entire research group headed by Zhao Zongxian [9392 1813 6343] and Chen Liquan [7115 4539 3123]. In conducting this research, we have always advocated the "group championship" spirit and the "coordinated activities" mentality in order to make full use of collective strength.

Physics research of an experimental nature usually has comprehensive characteristics. In the case of superconducting materials, for example, the work of searching for new materials with fine superconducting properties includes the preparation of materials, research in the superconducting properties, parameter measurement, and study of the relationship between material structure and the superconducting characteristics. It also touches on many technical fields such as low-temperature physics and technology, materials science, structural analysis, high-pressure physics, and theoretical physics. It would be impossible to do all these by relying on only one person or one group. Our institute is a multidiscipline and comprehensive research organ doing mainly research in the state of condensation. All the disciplines required for superconductivity research are included in the extensive field of our research. We organized the personnel of 11 project groups, including the key personnel of 4 groups, for this work, and obtained the assistance of low-temperature physicist Hong Zhaosheng [3163 2600 3932] and theoretical physicist Gan Zizhao [3927 1311 6856].

Of course, the superiority of a comprehensive organ cannot be brought into play without ideological and organizational work. We formed a special group to provide more active leadership over the research in superconductors. We particularly called on all the personnel engaged in this research to attach primary importance to our national reputation and collective reputation, and to do all they could in winning a "group championship." We held a regular meeting each week for each group to report on its progress. Any problem encountered would be brought up for general discussion, while tasks for the next stage were planned. The common objective and the unified leadership over the organization have turned this research organization into a truly united, harmonious, and militant collective.

Inspired by the will to win national glory and the title of "group champion" for themselves, everyone in the institute actively supported the research in superconductivity and coordinated his own work accordingly. To ensure that the supply of liquid helium would not be "interrupted" during the Spring Festival, one of the group leaders worked single-handedly on the first day of the lunar year. The workers also worked overtime along with the research personnel to be ready to recover the helium at any time. Any instrument or equipment sent to the processing plant was always attended to by the workers immediately... .

In the coordination of efforts from various quarters and under the guidance of a common ideal, China has its superiority, that is, the superiority of a socialist system. This was the superiority we relied on and brought into play.

Reliance on Long-Accumulated Experiences

In the laboratory, we met assistant researcher Zhao Zhongxian with blood-shot eyes from working overnight. He said:

The great breakthrough made within such a short period is closely related to the long-accumulated experiences in science, techniques, and technologies in practical experiments.

Our institute made the earliest start in low-temperature physics research in China. I worked in this field after I graduated from China Science and Technology University, specializing in low-temperature physics. Since the downfall of the "gang of four" in 1976, we have always worked in a stable social environment and become a fairly strong work force. We also gradually made achievements which, as a technical reserve, directly contributed to the breakthrough. That was why when I read the report that some Swiss scientists believed in the existence of superconductors with a transition temperature above 30 K among oxidized barium, lanthanum, and copper, I immediately joined the comrades concerned in coming to this conclusion: The breakthrough can be made if we can find superconducting materials with a high critical temperature from oxidized materials.

Preparation of materials is an important part of the research in superconductors with a high critical temperature. The production of new materials cannot be explored without profound scientific know-how and long-accumulated technical experiences. Chen Liquan and the other comrades, who had long engaged in crystallography research, are highly qualified in materials research. When they joined the other comrades doing research in superconductivity, they soon penetrated deep into this field, improved the technology, and reproduced them in good time.

After the production of the materials, the measurement of the high sensitivity, high stability and high resolution were also an important job. Because of their continued efforts in upgrading the technology, our research personnel were able to keep various instruments in excellent working

condition, to set up advanced monitoring systems, and to adopted advanced technologies as required at the same time.

Legacy of Hard Struggle Not To Be Abandoned

Chen Liquan, as the leader of the materials group, had long been engaged in superconductivity. His gaunt face showed signs of fatigue, but he braced himself for the interview. He said:

We have achieved first-rate success with second-rate equipment. The difficulties encountered at the start were rather serious. This project was first introduced by Zhao Zhongxian in September last year, after reading and analyzing the relevant documents. He talked to us and some comrades of the materials group, and we were all very interested. Some funds were then diverted from other projects for the purchase of raw materials, and we carried out the project in our spare time. We selected some discarded steel pipes and used them to make outer casts for several 1,000 watt electric stoves. It was from these stoves that superconductors with transition temperatures above 48.6 K were turned out last year.

We clearly understand that in view of the many formidable competitors in the world market, time means success for us. That was why nobody took any time off during the Spring Festival. In fact, we worked even harder, because such a quiet environment was rarely available. On 20 February, Chen Genghua [7115 6342 5478], after working overnight, discovered a superconductor with a transition temperature above 100K. For its further confirmation, he continued to work another day and night. Zhao Zhongxian, who was in overall charge of the project, was even more tired. He often worked around the clock for several days without even closing his eyes... .

In superconductivity research, we have always relied on our own resources and displayed the spirit of hard struggle until we were finally successful. Thus, the spirit of hard struggle as an legacy cannot be abandoned.

In the afternoon of 25 February 1987, Hu Qili [5170 0796 4539], Fang Yi [2455 3015], Song Jian [1345 0256], and some other state leaders came to the Institute of Physics of Chinese Academy of Science to congratulate and comfort all those who had participated in the superconductivity research. The scientists were greatly inspired. They expressed their determination to live up to the expectation of the party and the people, and continued to work day and night, while new difficulties and new successes await them.

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SHANGHAI SCIENTISTS SEE RESEARCH SUCCESSES

OW220648 Beijing XINHUA in English 0624 GMT 22 May 87

[Text] Shanghai, 22 May (XINHUA)--Shanghai scientists have been successes in their research over the past two years thanks to the country's ongoing scientific and technological reform.

The city's scientists carried out 2,100 research projects last year, a record high in the past few years, with 400 projects up to interntional standards. Key projects covered the areas of bioengineering, microelectronics and optical fiber communications.

China's scientific and technological reform has permitted scientists to contract for research projects and get paid by selling their research findings and newly-developed techniques.

Last year, the Shanghai Railway Science and Technology Research Institute completed 78 research projects, a 38 percent increase over the previous year.

Shanghai's research institutes have updated their labs and equipment with the funds raised from selling their research results.

Shen Juyun, a scientist at the Shanghai Silicate Institute won a national award in 1985 for his development of photochromic glass, and now has been invited as technological advisor and a deputy director at two glass factories where his technique is being used in production.

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RESOURCES, ENVIRONMENT INFORMATION LAB TO OPEN JULY 1987

OW271420 Beijing XINHUA in English 1203 GMT 27 May 87

[Text] Beijing, 27 May (XINHUA)--China is to open its resources and environment information laboratory in July, according to the Academy of Sciences of China today.

The lab, which was put into service last year, are conducting many key research projects for the Seventh Five-Year Plan (1986-1990) and has carried out extensive international cooperation projects.

The resources and environment information system, known as geographical information system in other countries, undertakes to process information on resources and environment collected through various modern means and provide them to policy decision makers. The opening of this lab is a step further toward making decision making more scientific and democratic from the technical side.

The lab has established a land information subsystem, which has already been applied in the selection of sites for railways and in the designing of communications network. Last year, it established an economic information subsystem. Preparations are being made to set up subsystems on the information of agriculture, forestry, mineral resources, water resources, and natural environment.

Zhou Guangzhao, president of the Chinese Academy of Sciences, said that the establishment of the geographical information system will help promote research into the planning of the Yangtze and Yellow River basins, the water conservation on the Loess Highlands, the desertification as well as municipal ecology and evolution of environment for the 1986-1990 period.

/12858
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INTERNATIONAL CONFERENCE ON FUTURE OF VLSI

Beijing DIANZI SHIJIE [ELECTRONIC WORLD] in Chinese No 1, 15 Jan 87 pp 2-3

[Article edited by Chen Datong [7115 1129 0681] and Zhang Zhongxuan [1728 6988 1357]: "10 Year Prospect of VLSI - Abstract from the 1986 International Semiconductor and Integrated Circuit Technology Discussion Meeting"]

[Text] The 1986 International Semiconductor and IC Technology Meeting was held on October 20-23 at the Xiangshan Hotel in Beijing. There were 130 foreign and 170 Chinese representatives attending the meeting. Many valuable papers were presented by world renowned semiconductor experts. On the evening of October 21, Professor Li Zhijian [2621 1807 1017] of Qinghua University presided a stimulating discussion session which involved several technical problems of common concern. The discussion was carried on by the 12 scholars sitting on the front table in a free manner. The audience could raise questions at any time. The 12 panel members were: 1) Li Zhijian of Qinghua University, PRC; 2) J. Stimmell of National Semiconductor, United States; 3) Y. Takeishi of Toshiba, Japan; 4) Yu Zhongyu [0205 1813 6877] of the Bureau of Microelectronics, Ministry of Electronic Industry, PRC; 5) K. Sasaswat of Stanford University, United States; 6) A. Laporte of Thompson Co., France; 7) M. Nagata of Hitachi, Japan; 8) E. H. Nicollian of the University of North Carolina, United States; 9) F. Kuznetsov of the National Academy of Sciences of the USSR; 10) K. Y. Chiu of the HP Co., United States; and 11) and 12) C. Lin-Hendel and . M. Melliar of Bell Labs, United States. Chen Datong and Zhang Zhongxuan, two doctoral students working under Professor Li Zhijian, were requested to take notes. An abstract of their notes is published as a reference for our readers.

1. What is the major trend in VLSI development in the next 10 years?

K. Saraswat: The primary object of future VLSI development is to offer more functions. One of the important means is to employ a multi-layer continuous line technique.

K. Y. Chiu: We should improve the performance/cost ratio of VLSI products to enhance the differential.

E. H. Nicollian: There are still many problems to solve. As the chip size grows further, problems such as sealing, noise interference resistance and power consumption must be investigated.

F. Kuznetsov: In the next 10 years, silicon will remain in the mainstream of VLSI. Nevertheless, we must also pay attention to other semiconductors. Compound semiconductors will play a certain role in the future.

K. Saraswat: In my opinion, VLSI development is not limited by device or physical factors. Instead, it is limited by system design. How can IC technology be fully utilized in systems. Multi-layer connection will improve the performance of the system. After an integrated system gets large, line delay becomes a problem. Optical connection is a promising way to solve the problem.

E. H. Nicollian: The current computer keyboard input mode should be changed. A computer should be able to handle input by natural languages such as graphics and sound. The development of integrated systems should be dedicated to this type of intelligent interface with transducers.

F. Kuznetsov: There is lot of work to do if we want to understand compound semiconductors as well as we know about silicon.

Yu Zhongyu: The MOS compatible bipolar technology, bi MOS, is a promising area to realize high speed and low power. Sub-micron MOS device has not yet reached its limit and still has some potential. Compound semiconductors have their advantages. However, silicon will still be the mainstream in the next 10 years. The interconnect and sealing of integrated systems must still be investigated.

C. M. Melliar: In the next 10 years, silicon devices will remain in the mainstream of the IC market. Price is an important issue. For example, 4-inch diameter silicon wafers will be replaced by 6-inch diameter ones because the latter costs less. (Someone raised the question that when will 8-inch wafer be available for practical use?) I believe that it will happen very soon. We can make 400 256k RAMs on a 4-inch wafer. On a 6-inch wafer, we can make 800. Thus, the cost of the wafer is lowered.

C. Lin-Hendel: I believe that in the next 10 years the 1-1.5 micron technology will be the mainstream of VLSI technology.

2. What is the trend of VLSI substrate material development?

K. Y. Chiu: To fabricate a silicon device on an insulating layer (i.e. SOI) has potential. However, there are too many defects in silicon for SOI technology. Moreover, the cost is too high. I am afraid it will take 10 years to be practical.

Y. Takeishi: The prospect of SOI technology using re-crtystallization technique is not very promising. It might be preferred to grow silicon on sapphire (SOS) over SOI.

Li Zhijian: The ultimate limit of making VLSI by SOI is the dissipation of power. Heat dissipation of the insulating substrate is not as good as silicon. A great deal of energy will remain concentrated.

3. Why do many Japanese firms and Bell Labs in the United States still spend a lot money on GaAs devices?

C. Lin-Hendel: At the present moment, the 1 micron silicon technology appears to be acceptable and will remain in the mainstream in the next 10 years. However, GaAs device is fast and will have a share in the marketplace. In addition, research funds will have to be spent in some area.

4. The concept of user defined logic is widely accepted. How can we provide user convenience and reasonable performance to price ratio?

Y. Takeishi: Custom design technology seems to satisfy some special user requirements. However, it is still not practical simply because the cost is too high.

5. What is the condition under which conventional photolithography cannot be used any longer?

Audience: Conventional photolithographic technique has no problem in the 1 micron range. It is estimated that it is still useful to 0.3 micron. As the lines gets thinner, circuit and system limitations are the main issues. For instance, the resistance of the connecting line will remain high.

Yu Zhongyu: Photolithography will not be a major problem in the next 10 years. The key issues are design method and more affordable software.

K. Saraswat: We can make 1 million devices on a single chip. Current technology can handle larger chips. However, the question is what to do with that many devices.

Y. Takeeishi: It can be used as very large scale memory device. For instance, graphics memory will require high capacity chips.

Li Zhijian: There is a big market in China. The main issue is price. Furthermore, dedicated integrated circuits are another direction for future VLSI development. At the present moment, this area is not sufficiently exploited.

6. What about the future of bipolar technology?

K. Y. Chiu: Bipolar technology is the original of integrated circuitry. The high speed circuit in the future will need bipolar technology as well. The bipolar MOS technology makes bipolar technology compatible with MOS technology, while retaining all advantages. It will have both high speed and low power features. It appears very promising.

7. How will yield and reliability be affected after chip area is increased?

C. Lin-Hendel: The present chip area is approximately 1 sq cm. There is no technology related problem. The yield is acceptable. The main issue is to provide more functions through IC technology.

K. Saraswat: In the past decades, the square root of chip area increased linearly with time. It is possible to achieve 1.5 square cm. However, it is projected that the growth rate will decrease by the late 1990's.

C. M. Melliar: It is positive that VLSI is feasible. It is already available. However, encapsulation is still a problem.

C. Lin-Hendel: Future VLSI encapsulation ought to be changed. As the chip area gets larger, the chip is, the number of pins also goes up. It is less favorable for sealing. We ought to consider the encapsulation of system, instead of that on the chip level.

8. How about the prospect of three-dimensional integration technology?

Y. Takeishi: Three-dimensional integration is still a long way off. It is in the research stage.

K. Saraswat: People on the applications end believe that multi-layer source structure is not as practical as multi-layer line structure because the connection between layers must be resolved in the former case.

9. Will single chip integration technology be developed?

K. Saraswat: Many U.S. companies are working on single chip integration. It is believed that it will appear in the marketplace soon. In the past, some companies failed in single chip integration. But, that does not explain the extent of the problem.

After the discussion, the deepest impression we had is that these experts are very practical. They focused on the feasibility of various new technologies in their current states. Next, they all put performance/cost ratio first and used market share as the criterion to judge the success of the technology. These should be inspiring points for the VLSI industry in China.

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BRIEFS

ASTRONAUTICS INSTITUTE SET UP--Harbin, 20 May (XINHUA)--The Astronautics Institute of the Harbin Polytechnic University was set up recently, according to the people's government of Heilongjiang Province. The institute offers six specialities including automatic control, communications engineering, electronic engineering, electronic instruments and surveying technology, and engineering mechanics. The institute, which is China's first astronautic institute of higher learning, will enroll students this year. The Harbin Polytechnic University was set up in 1920. It has graduated over 23,000 students and produced 1,300 postgraduates. It has also given in-service training to 1,400 teachers since 1950. [Text] [Beijing XINHUA in English 0121 GMT 20 May 87 OW] /12858

LASER SYMPOSIUM HELD IN CHENGDU--Chengdu, 1 Jun (XINHUA)--The fourth international symposium on gyrotron and free electron lasers opened here today in this capital city of southwest China's Sichuan Province. Attending the symposium are some 110 delegates from the United States, Britain, Federal Germany, France, Japan, the Soviet Union, and China. The symposium is the first of its kind to be held in China, marking the rapid advance the country has made in the field, said organizing officials. According to them, a total of 120 papers have been submitted to the 5-day symposium. [Text] [Beijing XINHUA in English 1347 GMT 1 Jun 87 OW] /12858

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33

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